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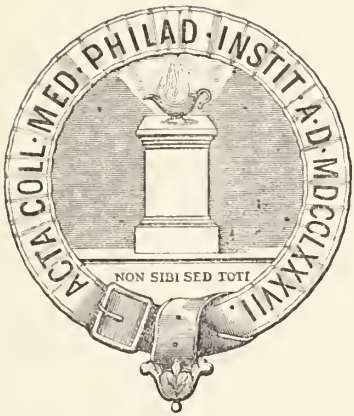

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1884.
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18870

LIST

OF THE

PRESIDENTS OF THE COLLEGE FROM THE TIME OF ITS INSTITUTION.

ELECTED

1787. JOHN REDMAN, M.D.

1805. WILLIAM SHIPPEN, M.D.

1809. ADAM KUHN, M.D.

1818. THOMAS PARKE, M.D.

1835. THOMAS C. JAMES, M.D.*

1835. THOMAS T. HEWSON, M.D.

1848. GEORGE B. WOOD, M.D., LL.D.

1879. W. S. W. RUSCHENBERGER, M.D.

1883. ALFRED STILLÉ, M.D., LL.D.

1884. SAMUEL LEWIS, M.D.

1884. J. M. DA COSTA, M.D., LL.D.

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* Died four months after his election.

FELLOWS

OF THE

COLLEGE OF PHYSICIANS OF PHILADELPHIA.

DECEMBER, 1884.

[Non-Resident Fellows are marked thus (*).]

ELECTED

1884. ABBOT, GRIFFITH E., M.D.

1870. ADLER, JOHN M., M.D.

1859. AGNEW, D. HAYES, M.D., LL.D., Professor of Surgery in the University of Pennsylvania, Consulting Surgeon to the Orthopædic Hospital and to St. Christopher's Hospital.

*1876. ALISON, ROBERT H., M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1867. ALLEN, HARRISON, M.D., Professor of Physiology in the University of Pennsylvania, Consulting Surgeon to the Mission Hospital.

1873. ALLIS, OSCAR H., M.D., Surgeon to the Presbyterian Hospital and to the Howard Hospital.

1869. ANDREWS, T. HOLLINGSWORTH, M.D., Surgeon to the Howard Hospital, Consulting Surgeon to the Hospital of the Good Shepherd, Radnor.

*1882. ASHBRIDGE, RICHARD, Assistant Surgeon U. S. Navy.

1872. ASHBRIDGE, WILLIAM, M.D., Surgeon for Out-patients to the Pennsylvania Hospital.

1863. ASHHURST, JOHN, Jr., M.D., Professor of Clinical Surgery in the University of Pennsylvania, Surgeon to the Children's Hospital, Consulting Surgeon to St. Christopher's Hospital and to the Hospital of the Good Shepherd, Radnor.

ELECTED

1865. Ashhurst, Samuel, M.D., Surgeon to the Children's Hospital.

1835. Ashmead, William, M.D.

1857. Atlee, Walter F., M.D., Consulting Physician and Surgeon to St. Luke's Hospital, Bethlehem.

1852. Bache, Thomas Hewson, M.D.

1883. Baer, Benjamin F., M.D., Demonstrator of Clinical Gynæcology and Chief of the Dispensary for Diseases of Women in the University of Pennsylvania, Obstetrician to the Maternity Hospital.

1879. Baker, Washington H., M.D., Obstetrician to the State Hospital for Women and Infants, Assistant Physician to the Philadelphia Lying-in Charity and to St. Christopher's Hospital, Assistant Surgeon to the Orthopædic Hospital, Physician to the Philadelphia Dispensary.

1876. Baldwin, Louis K., M.D., Examining Physician to the Hospital of the Good Shepherd, Radnor.

1880. Bartholow, Roberts, M.D., Professor of Materia Medica and General Therapeutics in the Jefferson Medical College.

1883. Baum, Charles, M.D.

1873. Baxter, H. F., M.D.

1884. Beates, Henry, M.D.

1860. Benner, Henry D., M.D.

1874. Bennett, W. H., M.D., Physician to the Episcopal Hospital and to St. Christopher's Hospital.

1884. Biddle, Alexander W., M.D.

1884. Biddle, Thomas, M.D.

*1866. Black, J. J., M.D.

*1867. Boardman, Charles H., M.D.

1859. Boker, Charles S., M.D., Surgeon to St. Joseph's Hospital.

1884. Bradford, Thomas Hewson, M.D.

1856. Brinton, John H., M.D., Professor of the Practice of Surgery and Clinical Surgery in the Jefferson Medical College, Surgeon to St. Joseph's Hospital, and Consulting Surgeon to the Southwestern Hospital of Philadelphia.

ELECTED

1878. Bruen, Edward T., M.D., Assistant Physician to the Hospital of the University of Pennsylvania, and Demonstrator of Clinical Medicine in the same, Physician to the Philadelphia Hospital, Examining Physician to the Hospital of the Good Shepherd, Radnor.

*1851. Bullock, William R., M.D.

1870. Burnett, C. H., M.D., Professor for Diseases of the Ear in the Philadelphia Polyclinic, Aurist to the Presbyterian Hospital, Consulting Aurist to Pennsylvania Institution for the Deaf and Dumb.

1880. Chapman, Henry C., M.D., Professor of the Institutes of Medicine and of Medical Jurisprudence in the Jefferson Medical College.

1868. Cheston, D. Murray, M.D., Physician to the Children's Hospital.

1873. Clark, Leonardo S., M.D.

1872. Cleemann, Richard A., M.D.

*1842. Clymer, Meredith, M.D.

1871. Cohen, J. Solis, M.D., Honorary Professor of Laryngology in the Jefferson Medical College, Professor of Diseases of the Throat and Chest in the Philadelphia Polyclinic and College for Graduates in Medicine, and Physician to the German Hospital.

1866. Cruice, R. B., M.D., Surgeon to St. Joseph's Hospital.

1873. Cruice, W. R., M.D.

1884. Curtin, R. G., M.D., Lecturer on Physical Diagnosis at the University of Pennsylvania, Assistant Visiting Physician to the University Hospital and the Philadelphia Hospital.

1884. Da Costa, J. C., M.D., Gynæcologist to the Jefferson Medical College Hospital.

1858. Da Costa, J. M., M.D., Professor of the Principles and Practice of Medicine in the Jefferson Medical College, Physician to the Pennsylvania Hospital, Consulting Physician to the Children's Hospital, to the Northern Dispensary, and to the Pennsylvania Free Dispensary for Skin Diseases.

ELECTED

1859. Darrach, James, M.D., Consulting Surgeon to the Germantown Hospital.

1874. Deakyne, A. C., M.D.

*1870. Deal, L. J., M.D.

1864. Downs, R. N., M.D., Consulting Physician to the Germantown Hospital.

1884. Drysdale, T. M., M.D.

1864. Duer, E. L., M.D., Accoucheur to the Philadelphia Hospital, Surgeon to the State Hospital for Women and Infants, Visiting Physician to the Preston Retreat.

1871. Duhring, L. A., M.D., Clinical Professor of Skin Diseases in the Hospital of the University of Pennsylvania, Physician to the Dispensary for Skin Diseases.

1881. Dulles, Charles Winslow, M.D., Surgeon to the Out-Patient Departments of the Hospital of the University of Pennsylvania and of the Presbyterian Hospital.

1863. Dunglison, Richard J., M.D.

*1871. Dunglison, Thomas R., M.D.

*1849. Dunott, Justus, M.D.

1860. Dunton, William R., M.D., Consulting Physician to the Germantown Hospital.

1882. Edwards, Joseph F., M.D.

1880. Eskridge, J. T., M.D., Physician to Jefferson Medical College Hospital, Physician to St. Mary's Hospital.

1868. Evans, H. Y., M.D., Physician to the Charity Hospital.

1884. Fenton, Thomas H., M.D.

1872. Finn, W. H., M.D., Surgeon to St. Christopher's Hospital.

1866. Fischer, Emil, M.D.

1884. Fisher, Henry M., M.D.

1862. Forbes, William S., M.D., Demonstrator of Anatomy in the Jefferson Medical College, Surgeon to the Episcopal Hospital.

1870. Ford, W. H., M.D.

ELECTED

1884. Formad, H. F., M.D.

1864. Fricke, Albert, M.D.

1870. Gardette, E. B., M.D.

*1873. Gerhard, George S., M.D.

1864. Getchell, F. H., M.D., Obstetric Physician to the Catharine Street Dispensary.

*1846. Gibbons, Henry, M.D.

*1848. Given, Robert A., M.D.

*1854. Gobrecht, William H., M.D.

1884. Godey, Harry, M.D.

1868. Goodell, William, M.D., Professor of Clinical Gynæcology in the University of Pennsylvania, Physician in Charge of the Preston Retreat, Consulting Physician to the Lying-in Department of the Northern Dispensary.

1867. Goodman, H. Earnest, M.D., Surgeon to Wills Hospital and to the Orthopædic Hospital, Consulting Surgeon to the State Hospital for Women and Infants.

1864. Granger, William H., M.D.

1857. Green, Alfred, M.D.

1870. Grier, M. J., M.D.

*1883. Griffith, J. P. Crozer, M.D.

1842. Griscom, John D., M.D.

1883. Gross, Ferdinand H., M.D., Surgeon to the German Hospital.

1868. Gross, Samuel W., M.D., Professor of the Principles of Surgery and Clinical Surgery, and Lecturer on Diseases of the Urino-Genital Organs in the Jefferson Medical College and Surgeon to the Hospital of the same, Consulting Surgeon to the Northern Dispensary and to the Pennsylvania Free Dispensary for Skin Diseases.

1871. Grove, John H., M.D., Surgeon to St. Mary's Hospital.

1863. Hall, A. Douglass, M.D., Surgeon to Wills Hospital.

1865. Hamilton, George, M.D.

*1859. Hammond, William A., M.D.

ELECTED.

1865. HARLAN, GEORGE C., M.D., Surgeon to Wills Hospital, Ophthalmic and Aural Surgeon to the Pennsylvania Hospital.

1863. HARLOW, LEWIS D., M.D.

1862. HARRIS, ROBERT P., M.D.

1847. HARTSHORNE, EDWARD, M.D.

1851. HARTSHORNE, HENRY, M.D., LL.D.

*1849. HASTINGS, JOHN, M.D.

1855. HATFIELD, NATHAN L., M.D., Consulting Physician to the Northern Dispensary.

1872. HAYS, I. MINIS, M.D.

1882. HEARN, JOSEPH, M.D., Surgeon to the Hospital of the Jefferson Medical College, and Surgeon to the Philadelphia Hospital.

1884. HENRY, F. P., M.D., Professor of Pathology and Microscopy in the Philadelphia Polyclinic, Physician to the Hospital of the P. E. Church.

1853. HEWSON, ADDINELL, M.D.

1872. HINKLE, A. G. B., M.D.

1879. HOPKINS, WILLIAM BARTON, M.D., Surgeon to the Episcopal Hospital, and Surgeon for Out-Patients to the Pennsylvania Hospital.

1867. HORN, GEORGE H., M.D.

1884. HORWITZ, PHINEAS T., M.D.

1868. HOWELL, SAMUEL B., M.D., Professor of Mineralogy and Geology in the University of Pennsylvania.

1882. HUGHES, DANIEL E., M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College.

1881. HUIDEKOPER, RUSH SHIPPEN, M.D., Professor of Internal Pathology and Contagious Diseases in the Veterinary Faculty of the University of Pennsylvania.

1884. HUNT, J. GIBBONS, M.D.

1854. HUNT, WILLIAM, M.D., Surgeon to the Pennsylvania Hospital and to the Orthopædic Hospital.

1863. HUTCHINSON, JAMES H., M.D., Physician to the Pennsylvania Hospital and to the Children's Hospital.

ELECTED

1871. Ingham, James V., M.D.

1867. Judson, Oliver A., M.D.

1877. Keating, John M., M.D., Obstetrician to the Philadelphia Hospital, Physician to St. Joseph's Hospital.

1849. Keating, William V., M.D., Physician to St. Joseph's Hospital.

1867. Keen, William W., M.D., Professor of the Principles and Practice of Surgery in the Woman's Medical College of Pennsylvania, Surgeon to St. Mary's Hospital, Consulting Surgeon to the Mission Hospital, and to the Philadelphia Home for Incurables.

*1844. King, Charles R., M.D.

1875. Kirkbride, J. J., M.D., Physician for Out-patients to the Pennsylvania Hospital.

1848. Klapp, Joseph, M.D., Physician to the Howard Hospital.

*1865. LaRoche, C. Percy, M.D.

1864. Leedom, John M., M.D.

1883. Leffmann, Henry, M.D., Demonstrator of Chemistry in the Jefferson Medical College, Professor of Chemistry and Metallurgy in the Pennsylvania College of Dental Surgery.

1851. Leidy, Joseph, M.D., LL.D., Professor of Anatomy in the University of Pennsylvania.

1855. Lewis, Francis W., M.D.

1877. Lewis, Morris J., M.D., Physician to the Episcopal Hospital, Assistant Physician to the Children's Hospital, and to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1849. Lewis, Samuel, M.D.

1836. Littell, S., M.D., Consulting Surgeon to the Philadelphia Dispensary, Emeritus Surgeon to Wills Hospital.

ELECTED

1877. LONGSTRETH, MORRIS, M.D., Lecturer on Pathological Anatomy in the Jefferson Medical College, Physician, and Pathologist and Curator, to the Pennsylvania Hospital.

1849. LUDLOW, JOHN L., M.D., Physician to the Philadelphia Hospital and to the Presbyterian Hospital.

1875. MCCLELLAN, GEORGE, M.D., Surgeon to the Philadelphia Hospital.

1871. MCFERRAN, J. A., M.D., Physician to the Gynæcological Hospital and Infirmary for Diseases of Children.

*1850. MAYER, EDWARD H., M.D.

1868. MEARS, J. EWING, M.D., Demonstrator of Surgery in the Jefferson Medical College and Gynæcologist to the Hospital of the same, Surgeon to St. Mary's Hospital.

1875. MEIGS, ARTHUR V., M.D., Physician to the Pennsylvania Hospital and to the Children's Hospital.

1881. MILLS, CHARLES K., M.D., Professor of Diseases of the Mind and Nervous System, in the Philadelphia Polyclinic and College for Graduates in Medicine, Lecturer on Mental Diseases and Electro-Therapeutics in the University of Pennsylvania, Neurologist to the Philadelphia Hospital.

1856. MITCHELL, S. WEIR, M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases, Consulting Physician to the State Hospital for Women and Infants.

1882. MONTGOMERY, EDWARD E., M.D., Obstetrician to the Philadelphia Hospital.

1863. MOREHOUSE, GEORGE R., M.D., Physician to St. Joseph's Hospital.

1883. MORRIS, HENRY, M.D.

1856. MORRIS, J. CHESTON, M.D., Consulting Physician to the Mission Hospital.

1861. MORTON, THOMAS G., M.D., Surgeon to the Pennsylvania Hospital and to the Orthopædic Hospital, Consulting Surgeon to the Jewish Hospital, Emeritus Surgeon to Wills Hospital.

ELECTED

1864. Moss, William, M.D.

1882. Musser, John H., M.D., Chief of the Medical Dispensary of the Hospital of the University of Pennsylvania, Pathologist to the Presbyterian Hospital.

1883. Musser, Milton B., M.D.

1865. Nebinger, Andrew, M.D., Physician to St. Mary's Hospital.

1869. Norris, Herbert, M.D., Physician to the Catharine Street Dispensary.

1865. Norris, Isaac, Jr., M.D.

1870. Norris, John C., M.D.

1866. Norris, William F., M.D., Clinical Professor of Diseases of the Eye in the Hospital of the University of Pennsylvania, Surgeon to Wills Hospital

1884. Oliver, Charles A., M.D., Ophthalmic and Aural Surgeon to the Dispensary Department of St. Mary's Hospital.

1884. O'Neill, J. W., M.D.

1858. Packard, John H., M.D., Surgeon to the Pennsylvania Hospital and to St. Joseph's Hospital.

1864. Pancoast, William H., M.D., Professor of General, Descriptive, and Surgical Anatomy in the Jefferson Medical College, Surgeon to the Philadelphia Hospital, Consulting Surgeon to the Charity Hospital and to the Pennsylvania Free Dispensary for Skin Diseases.

1882. Parish, William H., M.D., Professor of Anatomy in the Woman's Medical College, and Obstetrician to the Philadelphia Hospital.

*1854. Parrish, Joseph, M.D.

1883. Parvin, Theophilus, M.D., Professor of Obstetrics and Diseases of Women and Children in the Jefferson Medical College.

1854. Penrose, R. A. F., M.D., LL.D., Professor of Obstetrics and Diseases of Women and Children in the University of Pennsylvania, Consulting Obstetrician to the State Hospital for Women and Infants, Visiting Physician to the Preston Retreat.

ELECTED

1868. PEPPER, WILLIAM, M.D., LL.D., Provost, and Professor of the Theory and Practice of Medicine and of Clinical Medicine in the University of Pennsylvania.

1883. PIERSOL, GEORGE A., M.D., Assistant Demonstrator of Normal Histology in the University of Pennsylvania.

1872. PORTER, WILLIAM G., M.D., Surgeon to the Presbyterian Hospital and to the Philadelphia Hospital.

1883. RANDOLPH, N. ARCHER, M.D., Assistant Demonstrator of Physiology in the University of Pennsylvania.

1866. REED, THOMAS B., M.D., Surgeon to the Presbyterian Hospital.

1842. REESE, JOHN J., M.D., Professor of Medical Jurisprudence in the University of Pennsylvania, Physician to St. Joseph's Hospital, and to the Gynæcological Hospital and Infirmary for Diseases of Children.

1884. REX, FRANCIS M., M.D.

1883. REX, OLIVER P., M.D., Physician to the Jefferson Medical College Hospital.

1871. RICHARDSON, ELLIOT, M.D., Lecturer on Practical Obstetrics in the University of Pennsylvania, Surgeon for Out-patients to the Pennsylvania Hospital, Obstetric Physician to the Philadelphia Dispensary, and Physician to the Catharine Street Dispensary.

1869. RICHARDSON, JOSEPH G., M.D., Professor of Hygiene and Demonstrator of Histology in the University of Pennsylvania, Physician to the Presbyterian Hospital, Physician for Out-patients and Microscopist to the Pennsylvania Hospital.

*1857. RICHARDSON, TOBIAS G., M.D.

1882. ROBERTS, A. SYDNEY, M.D., Visiting Surgeon to the Philadelphia Hospital and the Orthopædic Dispensary of the University Hospital, Instructor in Orthopædic Surgery in the University of Pennsylvania.

1878. ROBERTS, JOHN B., M.D., Professor of Anatomy and Surgery in the Philadelphia Polyclinic, Surgeon to St. Mary's Hospital.

ELECTED

1843. Rodman, Lewis, M.D., Visiting Physician to the Preston Retreat.

1838. Ruschenberger, W. S. W., M.D., Medical Director U. S. N., retired.

*1852. Sargent, Fitz William, M.D.

*1864. Sargent, Winthrop, M.D.

1866. Schaffer, Charles, M.D.

1870. Schell, Henry S., M.D., Surgeon to Wills Hospital, Ophthalmic and Aural Surgeon to the Children's Hospital.

1875. Seyfert, Theodore H., M.D., Physician to the Gynæcological Hospital and Infirmary for Diseases of Children.

1884. Shaffner, Charles, M.D.

1877. Shakespeare, Edward O., M.D., Lecturer on Refraction and Accommodation of the Eye, and on Operative Ophthalmic Surgery, in the University of Pennsylvania, Pathologist and Ophthalmologist to the Philadelphia Hospital.

1868. Shapleigh, E. B., M.D.

1876. Shippen, Edward, M.D., U. S. N.

1880. Simes, J. H. C., M.D., Professor of Genito-Urinary and Venereal Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine, and Assistant Surgeon to the Episcopal Hospital.

1873. Simpson, James, M.D., Physician to St. Mary's Hospital.

1872. Sinkler, Wharton, M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1863. Smith, Albert H., M.D., Consulting Surgeon-Accoucheur to the Woman's Hospital, Consulting Accoucheur to the Preston Retreat, Physician to the Hospital of the Good Shepherd, Radnor.

*1863. Smith, A. K., M.D., U. S. A.

1864. Smith, Edward A., M.D.

*1856. Smith, R. K., M.D.

1884. Smith, Robert Meade, M.D.

1864. Spooner, Edward A., M.D.

ELECTED

1875. STARR, LOUIS, M.D., Physician to the Children's Hospital, Philadelphia, Lecturer on Diseases of Children in the Post-Graduate and Fourth Year Courses at the University of Pennsylvania.

1884. STELWAGON, H. W., M.D.

1842. STILLÉ, ALFRED, M.D., LL.D., Professor Emeritus of the Theory and Practice of Medicine in the University of Pennsylvania, Consulting Physician to the State Hospital for Women and Infants.

1846. STOCKER, ANTHONY E., M.D.

1871. STRAWBRIDGE, GEORGE, M.D., Clinical Professor of Diseases of the Ear in the Hospital of the University of Pennsylvania, Surgeon to Wills Hospital, Ophthalmic Surgeon to the Presbyterian Hospital, Surgeon to the Eye and Ear Department of the Philadelphia Dispensary.

1884. STRYKER, S. S., M.D.

1867. TAYLOR, R. R., M.D.

1867. THOMAS, CHARLES H., M.D., Surgeon to the Philadelphia Hospital.

1869. THOMSON, WILLIAM, M.D., Honorary Professor of Ophthalmology in the Jefferson Medical College, and Ophthalmic Surgeon to the Hospital of the same.

*1854 TILDEN, W. P., M.D.

*1870. TURNER, A. PAUL, M.D.

1866. TYSON, JAMES, M.D., Professor of General Pathology and Morbid Anatomy in the University of Pennsylvania, Physician to the Philadelphia Hospital.

*1852. TYSON, JAMES L., M.D.

1864. VANDYKE, E. B., M.D.

1873. VAN HARLINGEN, ARTHUR, M.D., Professor of Diseases of the Skin in the Philadelphia Polyclinic and College for Graduates in Medicine, Consulting Physician to the Dispensary for Skin Diseases, Dermatologist to the Howard Hospital.

1883. VINTON, CHARLES HARROD, M.D.

ELECTED

1852. WALLACE, ELLERSLIE, M.D., Professor Emeritus of Obstetrics and Diseases of Women and Children in the Jefferson Medical College, Consulting Obstetrician to the State Hospital for Women and Infants, Visiting Physician to the Preston Retreat, Consulting Physician to the Lying-in Department of the Northern Dispensary.

1873. WALLACE, W. H., M.D.

1875. WEBB, WILLIAM H., M.D.

1883. WELCH, WILLIAM M., M.D., Physician to Municipal Hospital for Contagious Diseases.

1884. WHARTON, H. R., M.D.

1883. WHELEN, ALFRED, M.D.

1878. WHITE, J. WILLIAM, M.D., Demonstrator of Surgery and Lecturer on Venereal Diseases in the University of Pennsylvania, Surgeon to the Philadelphia Hospital.

1880. WILLARD, DEFOREST, M.D., Lecturer on Orthopædic Surgery in the University of Pennsylvania, Surgeon to the Presbyterian Hospital, Consulting Surgeon to Home for Crippled Children.

*1878. WILLIAMSON, JESSE, M.D.

1851. WILSON, ELLWOOD, M.D., Consulting Physician to the Philadelphia Lying-in Charity, Visiting Physician to the Preston Retreat.

*1881. WILSON, H. AUGUSTUS, M.D.

1874. WILSON, J. C., M.D., Lecturer on Physical Diagnosis in the Jefferson Medical College and Physician to the Hospital of the same, Physician to the Philadelphia Hospital.

1884. WIRGMAN, CHARLES, M.D.

1871. WISTAR, THOMAS, M.D.

1848. WISTER, CASPAR, M.D., Consulting Physician to the Philadelphia Dispensary.

1852. WISTER, OWEN JONES, M.D., Consulting Surgeon to the Germantown Hospital.

1865. WOOD, HORATIO C., M.D., Professor of Materia Medica, Pharmacy and General Therapeutics in the University of Pennsylvania and Clinical Professor of Diseases of the Nervous System in the Hospital of the same.

ELECTED

1880. WOODBURY, FRANK, M.D., Physician to the German Hospital.

1866. WOODS, D. F., M.D., Physician to the Presbyterian Hospital.

1878. WORMLEY, THEODORE G., M.D., LL.D., Professor of Chemistry in the University of Pennsylvania.

1860. WURTS, CHARLES STEWART, M.D.

1861. YARROW, THOMAS J., M.D.

*1840. ZANTZINGER, WILLIAM S., M.D.

[It is particularly requested that any change of appointment, etc., may be communicated to the Committee of Publication before the first of July, in each year, in order that the List may be made as correct as possible.]

ASSOCIATE FELLOWS.

[Limited to Fifty, of whom Twenty may be Foreigners.]

ELECTED

1873. ACLAND, HENRY W., M.D., F.R.S., Oxford, England.

1847. ATLEE, JOHN L., M.D., LL.D., Lancaster, Pennsylvania.

1876. BALDWIN, W. O., M.D., Montgomery, Alabama.

1876. BARKER, FORDYCE, M.D., New York.

1877. BARNES, ROBERT, M.D., London, England.

1876. BIGELOW, HENRY J., M.D., Boston, Massachusetts.

1876. BILLINGS, JOHN S., M.D., U. S. A., Washington, District of Columbia.

1876. BOWDITCH, HENRY I., M.D., Boston, Massachusetts.

1865. BUTCHER, R. G. H., M.D., Dublin, Ireland.

1877. BYFORD, WILLIAM H., M.D., Chicago, Illinois.

1877. CHAILLÉ, STANFORD E., M.D., New Orleans, Louisiana.

1876. CLARK, ALONZO, M.D., New York.

1876. COMEGYS, C. G., M.D., Cincinnati, Ohio.

1876. CORSON, HIRAM, M.D., Norristown, Pennsylvania.

1881. COURTY, AMÉDÉE, Montpellier, France.

1876. DAVIS, N. S., M.D., Chicago, Illinois.

1876. DONALDSON, F., M.D., Baltimore, Maryland.

1883. FAYRER, SIR JOSEPH, M.D., LL.D., F.R.S.

1868. FLINT, AUSTIN, M.D., LL.D., New York.

1878. FOTHERGILL, J. MILNER, M.D., London, England.

1876. GREEN, TRAILL, M.D., Easton, Pennsylvania.

1868. HAMILTON, FRANK H., M.D., LL.D., New York.

ELECTED

1883. Heath, Christopher, Esq., F.R.C.S., London, England.

1874. Jackson, J. Hughlings, M.D., London, England.

1876. Johnson, George, M D., F.R.S., London, England.

1876. Johnston, Christopher, M.D., Baltimore, Maryland.

1876. Jones, Joseph, M.D., New Orleans, Louisiana.

1876. King, James, M.D., Pittsburgh, Pennsylvania.

1876. Kinloch, R. A., M.D., Charleston, South Carolina.

1877. Lister, Sir Joseph, Bart., LL.D., F.R.S., London, England.

1865. Macleod, G. H. B., M.D., Glasgow, Scotland.

1876. Moore, E. M., M.D., Rochester, New York.

1876. Mowry, R. B., M.D., Allegheny City, Pennsylvania.

1873. Ogle, John W., M.D., London, England.

1874. Paget, Sir James, Bart., D.C.L., LL.D., F.R.S., London, England.

1842. Parker, Peter, M.D., Washington, District of Columbia.

1876. Pollock, A. M., M.D., Pittsburgh, Pennsylvania.

1876. Porcher, F. Peyre, M.D., Charleston, South Carolina.

1869. Valcourt, Th. de, Cannes, France.

1857. Valery, Gaetano, Florence, Italy.

1861. Velasco, Pedro Gonzales, Madrid, Spain.

CORRESPONDING FELLOWS.

ELECTED

1880. Carrow, Flemming, M.D., Canton, China.

1880. Chiara, Domenico, Milan, Italy.

1880. Wasseige, Adolphe, Liège, Belgium.

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NOTICE.

The present volume of Transactions contains the papers read before the College from November, 1883, to September, 1884, inclusive.

The Committee of Publication thinks it proper to say that the College holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its Transactions.

[Volume VII. of the Third Series of the Transactions has been edited by the Recorder, Dr. J. Ewing Mears.]

A SKETCH OF THE LIFE

OF

THOMAS STEWARDSON, M.D.,

AN ASSOCIATE OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

By

W. S. W. RUSCHENBERGER, M.D.

[Read November 7, 1883.]

Dr. Stewardson was a son of Thomas Stewardson, who was born and lived more than a score of years in Westmoreland, England, where his ancestors had been settled during many generations on the family estate. Towards the close of the last century, Thomas Stewardson visited Philadelphia on business, intending to return to London after its transaction. The realization of this intention seems to have been delayed at first by his becoming zealously interested in the condition of the aborigines of the country, and then by very important business engagements. It appears that he often stated to his friends that he intended to return to England to live.

Nevertheless, on the 14th of April, 1796, he was married in the High Street Meeting-House of Philadelphia, to Anna, a daughter of John Head, whose father, of Bury St. Edmonds, England, settled in Philadelphia in 1717.

His subsequent career evinced a benevolent and philanthropic disposition. He served as an inspector of the public

prisons, and from 1808 till 1841, more than thirty-three years, he was one of the Managers of the Pennsylvania Hospital. His undoubted integrity, sagacity in business, scrupulous exactness in small things, and firmness of character enhanced the influence of his judgment and counsels in the Board and secured him respect in the community. A weak point with him was fastidiousness in securing a particular shade of color for his garb or raiment, and especially in matching his small-clothes and silk stockings, due possibly to an unusually acute sensitivity for color, which enabled him to perceive the minutest difference of shades, and made him a troublesome customer to drapers. The point is notable in connection with a statement of Francis Galton, that color-blindness is nearly twice as prevalent among Quakers, as among the rest of the community.[1]

Dr. Stewardson, who was the third son and the youngest of five children, was born in Philadelphia July 10, 1807.

Both of his parents and their ancestors were members of the Society of Friends.

Young Stewardson completed his scholastic education in the William Penn Charter School, while Joseph Roberts taught mathematics and the English branches; and Thomas Dugdale directed the classical studies of the pupils. The teaching was thorough. The course of study embraced enough learning to qualify those who completed it to enter the freshman class of any American college. The pupils who passed through the hands of Dugdale and Roberts were well prepared to become successful students.

One of his companions in the school remembers that

[1] P. 47. Inquiries into Human Faculty and its Development, by Francis Galton, F.R.S. Macmillan & Co., New York, 1883.

yonng Stewardson was considered by his school-fellows to be "a poky kind of boy."

It is related that he evinced, while still at school, interest in natnral history; that he had astonished and excited the admiration of some of his comrades by imparting unusual colors to flowers of certain hydrangeas growing in his garden, by a process he would not explain to them; and that he frequently accompanied a well-known local botanist, Mr. Solomon W. Conrad, in his Saturday afternoon walks in the rural environs of the city. They became intimate, and the youth confided to his senior that he intended to become a physician if possible.

At that period many elderly people believed that a vocation for a livelihood should be selected for young men, because, as a rule, they are not qualified to appreciate fairly their own capabilities and circumstances, and, therefore, not likely to choose judiciously for themselves. Under influence of a notion of this kind, Mr. Stewardson would not listen to the representations of his son in favor of the medical profession, but insisted very positively that he must be fitted for a commercial career. With this purpose in view he placed his son, as soon as he had completed his course at school, with Jared M. Brown and M. D. Lewis, commission merchants.

From time to time, when opportunity offered, Mr. Conrad, who was moved, no doubt by seeing his young friend coerced, as it seemed to him, to follow a vocation wholly distasteful while anxious to enter upon another which was congenial to his mind, ventured to speak to Mr. Stewardson on the subject, and advocate the propriety and reasonableness of Thomas's aspiration which, he said, he had learned while they were together on their botanical rambles.

Mr. Conrad's arguments induced Mr. Stewardson to consent very reluctantly that Thomas might study medicine. After a year's experience with the merchants, he became a pupil of Dr. Thomas Chalkley James, who was a member of the Society of Friends, and the first professor of midwifery in the University of Pennsylvania.

Having complied with all the requirements of the medical department of the University of Pennsylvania, the degree of Doctor of Medicine was conferred upon him March, 1830. His inaugural thesis was on Digestion.

He was immediately elected a resident physician of the Pennsylvania Hospital, in which he remained until April, 1832.

While in the hospital, he suffered from the effects of a dissecting wound, which was so serious that his recovery was ascribed solely to the attention and skill of Dr. John Rhea Barton.

At the end of his term in the hospital, he believed that he was not yet sufficiently qualified to begin the active career he had projected for himself. It was commonly supposed here, at that time and long after, that opportunities for acquiring practical and scientific knowledge of medicine were greater in the hospitals and schools of Paris than elsewhere, and that the kings of all the realms of the healing art resided there. Prominent among them were Dupuytren, Velpeau, Civiale, Ricord, Louis, Andral, Chomel, Trousseau, Magendie, and others, who, like Broussais, the author of the so-called physiological doctrine, have long since been dethroned, or have ceased to be renowned.

The celebrity of the French schools and teachers determined Dr. Stewardson to continue his studies in Paris.

In the early part of the summer, he engaged passage in a

packet bound from New York to Liverpool, but his mother, apprehensive that he might be unnecessarily exposed to contact with cholera, then reported to have broken out in Canada, objected to his departure from New York, although no case had occurred at that time either in New York or Philadelphia. Yet, in deference to his mother's wish, he relinquished his place in the packet and had the passage-money returned to him.

Then he endeavored to obtain passage on board of a ship about to sail from Philadelphia, but the owner, Mr. Thomas P. Cope, informed him that the whole of the cabin, except a single berth reserved for a surgeon of the ship, had been engaged. Mr. Cope was pleased to appoint Dr. Stewardson to the position. The principal passengers were General George Cadwalader, Joseph Bonaparte, ex-king of Spain, and his suite. Dr. Stewardson won the esteem of the ex-king, and at parting received from him some trinket in token of his regard.

Soon after his arrival in Paris he suffered from a sharp attack of pleurisy, a dreaded consequence of which alarmed him so much that, towards the close of September, he went to Nantes and remained some weeks, because he conjectured that there his convalescence would be more perfect and rapid than in Paris. A notion that phthisis would sooner or later follow his pleurisy entered his mind and possibly interfered with his labor.

The winter was passed in visiting the Parisian hospitals and attending Gouffroy's lectures on Philosophy, probably in company with several students from the United States. "If I mistake not," one of them wrote, "Dr. Stewardson's mind, like my own and some others among my friends, was unbalanced in regard to religious belief. We were

all discussing the high themes of life and death and the after death, and to him they brought, I fear, sorrow as they did to me. I well remember a remark let fall by Ralph Waldo Emerson, who was in Paris a few weeks, and with whom Dr. Stewardson and others held conversations on these matters. After speaking of having met Dr. Stewardson, Mr. Emerson remarked, 'The Doctor seems to want to be shriven.' "

Referring, in after years, to those conversations held in the happy and hopeful days of early manhood, Dr. Stewardson remembered that he was greatly startled at Emerson's pantheistic thoughts, and that their expression long reverberated through his memory and shook the foundations of his own confidence in the religious belief of his ancestors. To those conversations he seemed to trace the modification of his views, which resulted in his self-transfer from the Society of Friends to the Protestant Episcopal Church, to which he adhered till death.

In a letter to one of his old friends, August, 1873, he wrote: "You say your daughter has become an Episcopalian. So am I; for I like the Prayer-book and service. But when it comes to principles I must either have the very broad church or else the old Roman Catholic, and apostatize church *authority* or *free* thought. On the ground of *authority* there is one only church, the Roman Catholic. Some of these days if I live I must talk with you on these matters, but I cannot now. For myself I expect to hang on to the broad church, though some of our English Episcopalians are getting terribly broad indeed. Thirty years ago one would have called them infidels or something very near it."

In March, 1833, he embarked at Marseilles for Italy, visited Genoa, Florence, Civeta Vecchia, Rome, Naples,

Bologna, Francolino, Venice, Verona, Brescia, Milan, Geneva, and after an absence of about three months returned to Paris in the month of June.

About Oct. 1833, he was elected a member of La Société Médicale d'Observation, the purpose of which is to train its members in the laborious and difficult task of observing exactly, and recording accurately, the phenomena of diseases found in the hospitals of Paris or elsewhere. The society was founded in 1832, and still exists. Seven volumes of matter selected from its transactions have been published at long intervals between them. The motive for organizing the society was the hope of contributing towards the removal of an evil manifest in the fact that both ancient and modern medical literature abounds in imperfect, inaccurate, incomplete, and, for this reason, unreliable observations which therefore encumber and retard rather than promote the progress of medical science. M. Louis, the first president of the society, has treated the subject in detail in a paper "On the Method of Observing," a translation of which, by Dr. Henry I. Bowditch, was published in 1838.[1]

The society consists of only twenty-five members, and an unlimited number of honorary members, a class composed of those members who have removed from the French capital.

[1] De L'Examen des Malades, et de la Recherche des Faits Génereaux. Par M. Louis. Memoirs de la Société Médicale d'Observations, tome i., 1837.

Memoir on the proper Method of Examining a Patient and of arriving at Facts of a General Nature. By M. Louis, Physician to La Pitié, etc. Translated from the French by Henry I. Bowditch, M.D. etc. Dunglison's American Medical Library. Medical and Surgical Monographs. A. Waldie, Philadelphia, 1838.

When a candidate for membership is proposed he submits histories of at least three cases of the same disease and an analytical or critical summary of them, or of a collection of cases assigned to him by others. His papers are referred to a committee. The report of the committee is discussed and immediately after a ballot is cast, the affirmative vote of at least two-thirds of the members present being necessary to elect.

The president is elected for life, and the other officers annually. The society meets every Saturday, punctually at seven o'clock P. M., for two hours.

Dr. Stewardson, in a letter to his friend Dr. Gerhard, wrote: "My modesty won't permit me to tell you how much I was flattered by the encomium I received from Louis and the rest in relation to the mode in which my cases were drawn up, the analysis of them, etc. Since then I have read them an observation, and next week expect to read another. I find the advantage very great, and only wish I had become a member much sooner. Not the least advantage is my being brought into more close connection with Louis."

He earned first the commendation, and then the personal friendship of M. Louis, which was maintained by correspondence long after his return to Philadelphia.

In a letter, dated Paris, March 22, 1834, he expresses his admiration of M. Louis, and says that Broussais himself "has placed Louis at the head of all living physicians by devoting double the space, nearly two hundred pages, to the examination of his work, that he has to any of the others. I bought the book only yesterday, and have as yet read only a part of his examination of Louis's works, but I have read enough to justify me in saying that it is miserably weak

and puerile in point of argument, and what is worse, it is base and mean, inasmuch as he endeavors in various ways to take from him the character of originality as regards discoveries so positively his own, and besides, endeavors to undermine his character by accusing him of want of faith." Passages from Broussais are quoted to sustain these assertions.

During part or all of the time he sojourned in Paris, Dr. Stewardson's more or less intimate medical associates were Drs. W. W. Gerhard, George W. Norris, W. Pennock of Philadelphia, and Drs. Henry I. Bowditch, Robert Hooper, and Oliver Wendell Holmes of Boston. They were all in their halcyon days, "when each man passed for just what he was worth;" all looking hopefully if not ambitiously to their professional future. The friendships then formed between them and Dr. Stewardson were sincere, and proved to be life-long. Among them there was an amicable rivalry in work, in study, the effects of which have made them useful, eminent, or well known. Then they were intent not only to learn what was known, but by patient and constant observation, and analysis of their observations, to increase the stock of definite knowledge. In the estimation of all American students in Paris at that period, M. Louis was the leader, the trusty pioneer whom they should follow and imitate in their labors, because in their eyes his methods were rational and his abilities and acquirements were unsurpassed. They probably repeated his teachings and extended their influence.

Dr. Stewardson finally left Paris in May, 1834, and went to London. He remained there some weeks, and having fallen in with his Paris friend, Dr. Oliver Wendell Holmes, they travelled together in England and Scotland. They

parted company in the north of England, and Dr. Stewardson visited his relatives in Westmoreland. After an absence of more than three months he returned to London. Thence he wrote to his friend, Sept. 9, 1834. He remembered the time he had devoted in Paris "to collecting cases à la Louis, at La Pitié, not so much on account of the absolute information gained and labor performed, as for the influence it has exerted upon my mind. I long to get home to pursue the same course there." He expressed a desire to be again elected a resident of the Pennsylvania Hospital, that he might spend two years collecting cases, which he regarded as "an almost necessary base-work for future success in the line" which he proposed to pursue. Louis's paper on emphysema of the lungs he regarded as an important contribution to our knowledge of the disease, and therefore he intended to publish a translation of it; and he was pleased to say that Louis seemed to think well of the project when mentioned to him before leaving Paris.

Dr. Stewardson returned to his home November, 1834. He was then in the twenty-eighth year of his age. He had devoted seven years at home and abroad to the study of medicine, and now, zealous to contribute to its advancement, and his mind matured by foreign experience, he offered his professional services to his fellow citizens.

He became interested in several societies: was a member of the Philadelphia Medical Society; a fellow of the College of Physicians of Philadelphia from January, 1835; member of the Academy of Natural Sciences of Philadelphia, April, 1836; a member of the Friday Evening Medical Club. He was married April 6, 1837, to Hannah, a daughter of Henry Hollingsworth, Esq., a bank president. February, 1837, he was appointed a physician of the Phila-

delphia Hospital, and resigned May, 1838, when he was elected a physician of the Pennsylvania Hospital. He served the institution till 1845, seven years, when the condition of his health induced him to resign. About 1839 he was appointed physician of the City Hospital. He was a member of the Board of Health from March, 1838, till March, 1840. His name is on the list of collaborators of The American Journal of the Medical Sciences from November, 1836, till 1842.

All the duties which these appointments imposed were duly discharged, in addition to those of his professional practice and private business.

In the course of 1836 he wrote reviews of Dr. P. M. Latham's lectures on subjects connected with clinical medicine, and of Dr. W. W. Gerhard's Diagnosis of Diseases of the Chest, which were published in vol. xviii. 1836, of the American Journal of the Medical Sciences. Also of Auguste de Grissolle's Essai sur la Colique de Plomb, and a bibliographic notice of Isodore Bouvin's Récherches sur les Complications qui accompagnent la Rougéole chez l'Enfant, which appeared in vol. xix. 1836.

In the first volume of Medical and Surgical Monographs, of Dunglison's American Medical Library, 1838, may be found Dr. Stewardson's translation of Researches on Emphysema of the Lungs, by M. Louis, Physician of La Pitié, etc., 8vo. pp. 63.

A review of Anatomical, Pathological, and Therapeutic Researches on the Yellow Fever of Gibraltar of 1828, by P. Ch. A. Louis, etc., translated by G. C. Shattuck, M. D., was published in the American Journal of the Medical Sciences for November, 1839.

In the same journal for April, 1841, he published his

Observations on Remittent Fever, founded upon cases observed in the Pennsylvania Hospital.

In the issue for January, 1842, Case of Yellow Fever, with remarks; and in the number for April, of the same year, Observations on Remittent Fever, founded on cases observed in the Pennsylvania Hospital.

In the number for January, 1843, appeared Remarks upon the cases of Smallpox admitted into the City Hospital during the years 1840, 41, and 42. By Thomas Stewardson, M. D., Physician to the Institution.

In October, 1843, he finished the work of editing the first American edition of Dr. John Elliotson's Principles and Practice of Medicine, "with notes and additions by Thomas Stewardson, M.D., etc.," an octavo volume of 1046 pages, which was published by Carey & Hart, Philadelphia, 1844. The principal additions to this work made by him were a chapter on remittent fever, and another on yellow fever.

Early in 1844 he proposed to prepare a standard work on fevers, and in April agreed with Messrs. Lea & Blanchard upon the terms of its publication.

The record of the work he had done proves his zeal and industry; and at that time the character of it seemed to forecast eminence and prosperity. But the hope of his future was destroyed. Not long after he had arranged to publish his projected treatise on fevers he suffered from a severe attack of pneumonia, followed by an alarming pulmonary hemorrhage. His recovery was slow. Consultations of experts resulted in an opinion substantially that he could not continue to live in the climate of Philadelphia without probable development of pulmonary disease of a serious nature. Having suffered from pleurisy in Paris,

1832, he was ever after always more or less solicitous about his health, and now that he was advised to reside in a milder climate, and abate his labors, the baleful shade of invalidism clouded his mind, and rendered him ever after timid of exertion and exposure. In conformity to the recommendation of his medical advisers he determined to seek a milder climate, and selected Savannah, Georgia, as the place of his future abode.

With the regrets and sympathy of many warm friends he left Philadelphia November 12, 1845. Whatever he might have hoped to achieve by his labors to contribute to the progress of medical science, his career in this connection was closed. But he expected to practise his profession in his new home to the extent his health might permit.

As a consequence of his removal to the city of Savannah Dr. Stewardson had forfeited his fellowship in the College of Physicians, but as a token of the high estimation in which he was held by his colleagues at the time, he was elected an associate of the College January 5, 1847.

From the date of his departure from Philadelphia till January 6, 1846, he kept a diary. The following extract from it presents a graphic picture of what no one will ever behold again in this land, and at the same time a glimpse of our invalid's emotional character.

He was accidentally present at an auction sale of slaves, January 6, 1846. He wrote in his diary: "My heart ached . . . and I sympathized deeply with the poor creatures, and I could not help thinking the auctioneer did too, and I thought he seemed disposed to help them to good masters or mistresses, for a woman was one of the purchasers. Such occurrences are doubtless among the great evils of slavery, but good masters, I am satisfied, so greatly preponderate

that there are other evils of a free state among the same class of population which make a fair set off against it. Such public exhibitions are shocking to one's feelings, and must have a prejudicial influence on those who become accustomed to them. In my walk with Mr. H. on Saturday, on a rice plantation to the southwest of the town, a short distance below the railroad bridge, the water being obtained from an adjoining swamp still more to the south, I observed two negroes digging out the rice ditch, and on the bank stood another negro with a whip in his hand. This also made me feel *creepy*, and I inquired of Mr. H. if this was common. He said yes; it was customary on the rice plantations, and that the *negro* drivers were apt to be severe, laying on the lash whenever they choose to consider anything wrong. A little further on I saw a woman who had been at the same work in the ditch warming her wet, muddy feet over a little fire on the bank."

Dr. Stewardson established himself in Savannah, and soon obtained a large practice which he abandoned at the end of four years on account of ill health, and removed to Marietta, Cobb County, Ga. There he settled himself and family on a farm which was partly within the limits of the town. Living four years in contact with slavery had so far overcome his repugnance to the institution that he found it expedient to become the owner of a half dozen slaves.

Marietta at the time contained about three thousand inhabitants and was a resort in winter for invalids of the southern, and in summer for those of the northern parts of that region. He made there many friends, was highly esteemed, and frequently consulted professionally.

The Georgia Military Institute was established there in the spring of 1851, and opened with twenty-eight pupils.

The government of the United States furnished arms for its use.[1] At its organization the trustees elected Dr. Stewardson Professor of the Natural Sciences, a position which he resigned after two years' service. During the war of the rebellion the building of the Institute was burned, and has not been rebuilt.

After residing more than twelve years in Georgia he returned to Philadelphia in the autumn of 1858, seemingly in perfect health. Though he did not resume the practice of his profession, he renewed his connection with the College of Physicians, with the Friday Evening Medical Club, of which he was an original member, and with the Academy of Natural Sciences.

He read before the college an appropriate biographical memoir of his friend, Dr. William W. Gerhard, May 4, 1864, and for several successive years discharged the duties of the librarian during the summer vacations of the latter.

He had held the office of Recording Secretary of the Academy of Natural Sciences of Philadelphia from June, 1837, till January, 1840. His interest in the pursuits of the society revived on his return to the city. He was again elected a member April, 1859, and in December corresponding secretary, and annually thereafter till December, 1866; also, member of the publication committee on which he served till December, 1865.

Learning from French scientific periodicals that the ailanthus silk-worm had been brought from China to Turin in 1857, and that M. Guérin Méneville had introduced it into France in 1858, where it seemed likely to be extensively cultivated, Dr. Stewardson conjectured that it might thrive

[1] Historical Notes of Georgia. By Rev. George White, M.A. New York, 1855.

also in the United States. Early in 1860, through the kind agency of his friend, Mr. G. Roberts Smith, he procured from Paris specimens of this new silk-worm, Bombyx cynthia or Attacus cynthia, some of its cocoons and samples of the silk obtained from them in the state of crude, spun, and woven silk. Through the same agency he received from Paris, in the month of June, eggs of this bombyx. Mr. Evans, an intelligent manufacturer, who was pleased to co-operate in the effort to introduce the cultivation of this silk into the United States, succeeded in raising a few worms which formed their cocoons in July. Towards the middle of August the butterflies appeared, and the eggs laid by them hatched their worms between August 30th and September 3d. He distributed some of these worms on several ailanthus trees, and Dr. Stewardson placed others on a large ailanthus tree in a private garden in the city. Some he fed in a room in his own house and some in the hall of the Academy. Those placed in the open air were not injured although exposed to heavy rains and strong winds. His experiments convinced him that this worm could be raised in our country, and that two crops of them each season are obtainable in this latitude.

At a meeting of the Academy, March 5, 1861, Dr. Stewardson stated in detail his experiments and the results.[1]

Attention was again called to the subject at a meeting of the Academy, September 26, 1882. Dr. Leidy stated substantially that he had noticed an abundance of the ailanthus silk-worms, Attacus cynthia, upon the ailanthus trees, and that they had been introduced into this country by the late Dr. Stewardson, in 1860. Dr. E. J. Nolan, the recording

[1] Proceedings of the Academy of Natural Sciences of Philadelphia, vol. xiii. 1861, p. 525.

secretary, added that he had taken charge of Dr. Stewardson's collections soon after the appearance of the second crop of worms and supplied them with ailanthus leaves in his office; and afterwards had placed the worms in his possession, an aggregate of several hundred, upon an ailanthus tree in the yard of a house previously occupied by Dr. Hare, south of the medical department of the old University building on Ninth Street. They multiplied there, to such extent that entomologists have since recognized them as one of our naturalized species. There is no reason to doubt that the cynthia moth, as it is found in this section of the country, has descended from that colony.

The silk produced by the Attacus cynthia is of good quality, but the great difficulty of winding it from the cocoons renders it objectionable to manufacturers. It is said that the difficulty is obviated in China by carding them.

Dr. Stewardson was a member of the Board of Health in 1861, 62, 63, and resigned to accept the office of Lazaretto Physician, at the early part of 1864, to which he was appointed by the Governor of the State. He relinquished the post in the autumn in consequence of an unconquerable apprehension of being accidentally drowned some day while boarding vessels from a row boat in the line of his official duty.

He was again a member of the Board of Health from 1867 till 1872, inclusive, making an aggregate of eleven years' service in the Board.

In April, 1868, he was elected a corresponding member of La Société Imperiale Académique de Cherbourg.

Dr. Stewardson's death was ascribed to chronic disease of the stomach. From the date of his removal from Philadelphia until his last hour he never had a symptom of pulmo-

nary disturbance. If the diagnosis of his condition by experts in 1845 was accurate, the influence of the climate of Georgia was most salutary, for on his return home, 1858, his health, as already stated, seemed to be perfect, although the valetudinarian's carefulness of himself, which had its birth in Paris, and was virtually recreated by his unreserved confidence in the opinion given to him in 1845, haunted him more or less continuously till the end. If that opinion was not correct, as it may be possibly surmised in the light of subsequent experience, the error was of dismal import, for without conclusive reason it extinguished professional aspiration, marred the fortunes of the patient, and rendered a valuable life comparatively valueless during more than a quarter of a century.

Dr. Stewardson died June 30, 1878, almost at the end of his seventy-first year. His widow and their five children, two sons and three daughters, survived him. Mrs. Stewardson died January 25, 1880.

Dr. Stewardson was endowed with ability of a high order, and, though denied the advantages of collegiate training, his attainments were varied and extensive. He wrote well, and had the reputation of a pleasing and instructive clinical lecturer. His papers on yellow and remittent fevers were highly appreciated at the time of their publication, and it is conceded that he was the first to note the post-mortem condition of the liver in the latter, characterized by a bronze or slate color. He worked industriously to contribute to the progress of the science of medicine, and was noted for his skill in the art of treating diseases, especially those of the lungs. His diagnosis in these affections was considered to be as reliable as that of any practitioner of his day; but he himself awarded the first place in this connection to

his friend Dr. Gerhard. His examination of patients was notably deliberate, scrutinizing, careful; his diagnosis was cautiously given, and his therapeutic methods and formulas were simple.

Socially he was regarded as a high-toned, intelligent, well-educated gentleman and physician. He was very amiable, sensitive, quiet, modest, diligent, and, in his Parisian days, manifested a remarkable sensibility to music. One of his friends of that period says: "I cherish his memory as that of a most kind-hearted friend and a most agreeable companion, whom I always met with pleasure and parted from with regret."

A life closed at the end of threescore years and ten has had its allotted share of time, and yet may lack much else for its round completion, in things left undone which might have been done, but were not, and still without fault or indifference being fairly chargeable.

An amiable Christian gentleman, courteous, intelligent, well educated, diligent, as competent witnesses testify, started on life's campaign without apparent obstacle, with no cloud between him and the goal of his ambition, possibly urged on by friends expecting and predicting for him a brilliant triumph. His thirty-seventh year little more than completed, while sounds of approbation and even of applause were coming to him from the finished and notable labors of the first decade of his toil, he was stopped and overthrown in his path by alarming disease. After his recovery specialists reached a diagnosis which made the continuance of his life contingent upon a devotion of it to hygienic precaution. From partial lack of self-assertion, of intrepidity in his character, the practice of this precaution, though he was not an invalid in fact, fastened upon him a tyrannical

phantom of invalidism which dwarfed his energy, indirectly consumed his time and substance, and slowly reduced his ample means to be insufficient in the end to afford more than a very modest living for himself and family. In fact, so much and constant attention was injudiciously given to the prophylaxis of life itself that little time and energy were left for anything else. Had the specialists refrained from expressing an opinion in the case, may it not be conjectured now that he might have resumed and continued work at home, and, without closing his life a day sooner, attained scientific eminence far surpassing the expectation of his most sanguine friends?

The good quality of his original work is our apology for expressing regret that he did no more. The ills which overtake a man, as well as the success he may achieve, equally belong to a history of his life. Reference to his misfortunes does not lessen, but rather enhances, his merit.

In the death of Dr. Stewardson the College lost a worthy associate, and the community an esteemed gentleman.

A MEMORY

OF

DR. GEORGE FOX,

A FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

By

W. S. W. RUSCHENBERGER, M.D.

[Read November 7, 1883.]

George Fox, the youngest of the thirteen children of Samuel Mickle Fox and his wife Sarah, was born in a house which stood on the site of the post-office, on the south side of Chestnut Street, east of Fifth St., Philadelphia, May 8th, 1806. His mother was a daughter of Samuel and Mary Pleasant, whose birthright name was Pemberton. Of the thirteen children, four sons and nine daughters, eleven lived to adult age and beyond, and five of them married. Their grandfather Joseph Fox, who, in 1765, was the Speaker of the Colonial Assembly, married a daughter of Samuel Mickle, and had thirteen children. These family names are well known to those acquainted with the social history of Philadelphia about the beginning of this century. They all belong to members of the Society of Orthodox Friends, a sect of Christians who, through the example of their industrious habits, benevolence, moderate and discreet conduct, and unpretentious deportment, have so influenced the manners of citizens generally as to impart

a peculiar tone to the character of Philadelphia, and impose upon it a nickname of Quaker City.

The subject of this notice was a birth-right member of the Society, and during his life, while in the city, was an habitual attendant at its meetings.

This brief of lineage is sufficient to imply that Dr. Fox's ancestry was composed of vigorous, intelligent, and influential persons. He probably inherited their qualities.

His father died in 1808. The guardianship of his children devolved upon their mother, who was left in circumstances which required very strictly economical administration.

Dr. Fox passed through primary schools taught by Mrs. Saul and by Andrew Brown; and when ten years old, he was placed at James Tatham's Clermont Seminary on Nicetown Lane, and finally transferred to the school of Wylie and Engle in the city, all in their day reputable teachers.

In the autumn of 1822, he entered the Department of Arts of the University of Pennsylvania, and graduated in 1825, with so much credit that he divided the second honor of commencement with his life-long and intimate friend Adolph E. Borie, who became conspicuous as an unwilling member of President Grant's cabinet during about three months.

Thus educationally equipped he began, in 1825, to study medicine, nominally in the office of his brother, Dr. Samuel M. Fox,[1] a graduate of 1822, but in fact under the preceptorship of Dr. Joseph Parrish. The same year he lost his mother.

[1] Dr. Saml. M. Fox retired from the profession, and in 1828 removed to New York, where he became a partner in the mercantile firm of Bolton, Fox, and Livingston. He died there in 1849.

The degree of Doctor of Medicine was conferred upon him by the University of Pennsylvania March, 1828. Colic was the subject of his thesis.

Immediately after graduation he was elected one of the resident physicians of the Pennsylvania Hospital. His colleague during the first year was Dr. James A. Washington, and the second, Dr. Ralph Hammersly, both highly esteemed gentlemen and skilful practitioners.

During the first year of his residence in the Hospital Dr. Fox devised an apparatus for the treatment of fractures of the clavicle. Ten years afterwards, in No. 7 of the Medical Examiner, issued March 28, 1838, page 108, he published a "Description of an apparatus for the treatment of fractures of the clavicle," with a figure. He says: "The apparatus just described was introduced into the practice of the Pennsylvania Hospital in 1828 for the treatment of fractures and dislocations of the clavicle, and, as remarked by Dr. Wallace in his statistical account of Fractures, published in the second number of the Examiner, has since been used to the exclusion of other methods of treatment; its modifications were chiefly made at the suggestion of my friend, Dr. James A. Washington, of New York, then my colleague in that institution."[1]

The results of the use of the apparatus have been so generally satisfactory, especially in fractures of the acromial end of the bone, that it has not been superseded. Fox's apparatus has been employed during more than a half century, is still used in the hospital, and is figured and described in most of the recent text-books on surgery. Such long tenure of approbation is evidence of its superiority to

[1] Dr. Washington died in New York, August 30, 1847, æt. 46.

apparatus previously devised for the same purposes, as well as of the inventor's accurate appreciation of the difficulty of maintaining the fragments of a fractured clavicle steadily in their normal position until solidified by the natural process of repair with the least possible inconvenience to the patient. Prior to its introduction into practice many surgeons believed that deformity inevitably follows fracture of the clavicle; with this apparatus perfect cures are effected. Dr. George W. Norris says, in reference to it: "The chief indications in the treatment of fracture of the clavicle are perfectly fulfilled by the use of this apparatus; the pad in the axilla throws the shoulder outwards, at the same time that the drawing up of the elbow by the linen bag throws it upwards and backwards. Besides this, it is simple, requires no bandaging, and leaves the part injured at all times open to inspection. The apparatus, too, can readily be applied in females, in whom it is all important to obviate deformity.[1]"

Including his residence in the hospital, Dr. Fox had devoted five years to the study of medicine, and was, for that period, uncommonly well prepared to begin to practise it. The insufficient income of his home had probably made him from the start a diligent student of the healing art, to the practice of which he looked forward for increase of means, as well for the sake of those who were in some degree dependent upon him as for his own. In the spring of 1830, April, then just entering the twenty-fifth year of his life, he established himself at the northwest corner of Sansom and Twelfth streets, in a modest dwelling which he had built while he was a resident of the hospital to be a home for

[1] Page 140, Contributions to Practical Surgery, by George W. Norris, M.D., etc. Lindsay and Blakiston, Philadelphia, 1873.

himself and six unmarried sisters, of whom he had assumed the care since his mother's death. Almost at once he was employed as a general practitioner. He speedily acquired local reputation as a successful oculist, obstetrician, surgeon, and skilful physician. In a short time his practice became large and lucrative. There was a popular notion that he cured his patients.

His contributions to medical literature were few, but interesting, and always characterized by clearness of statement and good sense. The North American Medical and Surgical Journal, vol. xii., contains his first publication, "Relation of a case of labour in a female with deformed pelvis," June 14, 1831. Dr. Charles D. Meigs assisted him. He perforated the child's head with some difficulty. The woman recovered, and when she afterwards needed professional aid under like circumstances she placed herself in the care of Dr. Fox. Her perils were described by him in an interesting paper entitled, "Account of a case in which the Cæsarean Section, performed by Prof. Gibson, was a second time successful in saving both mother and child," which was published in the American Journal of the Medical Sciences, No. xliii., May, 1838. The patient stated that she had suffered much less in these operations than when delivered per vias naturales.[1]

He contributed to the same journal, No. xlix., November, 1839, "Report of cases of Diseases of the Eye, treated in the Wills Hospital during the months of April, May, and June, 1839," and to the issue for April, 1843, a paper entitled "Surgical Cases." Among them is a ligation of the femoral artery for the cure of traumatic aneurism of the anterior tibial, which was successful.

[1] The Medical Examiner, p. 15, vol. i., 1838.

The issue for January, 1849, p. 42, contains "Report of cases treated in the Pennsylvania Hospital. By George Fox, M.D., one of the Surgeons." Among them is an amputation at the shoulder-joint done immediately after serious injury. The patient speedily recovered.

"History of two cases of aneurism treated in the Pennsylvania Hospital. By George Fox, M.D., one of the Surgeons," appeared in the issue of the journal for October, 1849.

The external iliac artery of one patient, who had an inguinal aneurism, was tied, and the common carotid of the other, who suffered from an aneurism in the neck. Both patients were perfectly cured.

He read before the College, April 30, 1833, an account of "A case of pulmonary disease, supposed to be gangrene of the lungs, which ended in recovery;" and April 7, 1846, a "Biographical notice of the late Dr. Joseph Peace."

Dr. Fox was a Fellow of the College of Physicians of Philadelphia more than a half century. The active part which he took in its affairs led to the construction of the building in which it is established. For this reason reference to his connection with it may include some details, which, though trivial in themselves, may be, nevertheless, worthy the attention of Fellows of the present day.

His admission into the Society was in accordance with a by-law enacted at its organization and still operative at the time.

On the record of proceedings is the following note:—

Gentlemen: Desirous of becoming a member of your body, I beg leave to offer myself a candidate.

Respectfully,

August 30, 1831. GEORGE FOX.

He was unanimously elected a Fellow of the College September 27, 1831.

From October 25, 1831, when he was formally introduced and signed the constitution of the Society, Dr. Fox was usually present at the meetings, and soon became much interested in its affairs.

He served on the standing committee on materia medica and pharmacy from October, 1834, till May, 1837, and on that of surgery from the latter date till 1840.

It had been long generally admitted that the College was not satisfactorily accommodated, then meeting in an apartment of the American Philosophical Society, and not likely to be as long as its narrowly limited income required it to occupy a room, eligible on account of low rent rather than its adaptability to the purposes of the Society. It was a common conjecture that the dignity of the College would be enhanced in public estimation, and that its prosperity would be promoted by obtaining for it a permanent home of its own, in which a library and museum could be arranged conveniently for the use of the Fellows. But as opulence is not characteristic either of medical practitioners or of medical institutions, the realization of the idea was rather wished for than expected, and, therefore, a feasible measure to obtain the means necessary to secure it had not yet been devised.

In the autumn of 1840 a proposition was submitted that the College of Physicians, the Medical College of Philadelphia, and the Philadelphia Medical Society should join in the formation of the Medical Hall Association of Philadelphia, for the purpose of erecting a building for their common use.

This proposition was not approved of by the College.

On motion of Dr. Fox, November 3, 1840, a committee,

consisting of Drs. Fox, J. Rodman Paul, and D. F. Condie, was appointed "to ascertain what amount would be sufficient to authorize the erection by the College of a building for its accommodation and to solicit contributions from the fellows."

The report of this committee is not recorded on the minutes.

November 6, 1849, on motion of Dr. Fox, a committee of five was appointed to "ascertain and report to the College the probable cost of a lot and the sum necessary to erect thereon a building suitable for the accommodation of the College, and to suggest a plan for raising the funds estimated to be requisite for the execution of the project."

Drs. George Fox, G. B. Wood, I. Hays, J. R. Paul, and C. D. Meigs were appointed the committee.

At the next meeting, December, 1849, the committee submitted a report, in substance, that a building and site for it would probably cost twenty thousand dollars, and as it was not considered practicable or expedient for the College to involve itself in the proposed enterprise at that time, the creation of a building fund was recommended. It was proposed that the sources of the fund should be certain securities then held by the College, and such contributions to it as might be received from time to time, and that it should be confided to trustees to keep it separate from the money of the society until it should amount to twenty thousand dollars, and then be used exclusively for the purchase of a lot of ground and the erection thereon of a building suitable for the purposes of the College. The appointment of a committee to invite and receive contributions to the fund from the Fellows was also recommended.

In the opinion of Dr. Fox it was essential to the success

of his scheme that contributions received for purchasing a lot and the construction of a building should be vested in a trust created for the purpose in order that contributors might be assured that money given to the building fund could not be diverted to any other object. Otherwise, if the friends of the project were not made confident that it must be realized sooner or later, they might not be willing to give it substantial aid and encouragement.

All the recommendations submitted in the report were adopted.

At an adjourned meeting held January 15, 1850, Drs. George B. Wood, George Fox, and J. Rodman Paul were elected trustees of the building fund; and Drs. George Fox, D. F. Condie, Moreton Stillé, F. West, and George W. Norris were appointed a committee to invite and receive contributions from the Fellows.

The trustees of the building fund reported, January 6, 1851, that the par value of the securities in which the fund was invested, was $6546.16, and in January, 1859, that their par value somewhat exceeded $22,000. Although the sum had been acquired for the attainment of which the trust was created, and the trustees had requested that the College should decide upon its appropriation to the purpose intended, as might be considered expedient, it was determined that the fund should further accumulate, and accordingly the trust was extended for five years.

One of the articles of the agreement with Dr. Mütter in reference to the reception of his museum, which was executed January, 1859, stipulates that the College should within five years erect a fire-proof building containing an apartment of sufficient dimensions for the accommodation of the

museum and its probable increase. This stipulation was a motive for accelerating the work.

On the 2d of March, 1859, on motion of Dr. Fox, a committee was appointed to select and purchase a site suitable for the erection of a hall.[1] The committee reported, May 4, that it had purchased the lot at the northeast corner of Locust and Thirteenth streets, 42 × 110 feet.[2] This purchase was regarded as most judicious in every respect.

Believing that the disturbed condition of affairs then prevailing in the country was favorable to building cheaply, on motion of Dr. Hays, December 5, 1860, a committee was appointed to procure plans and estimates for a hall.[3] A plan and estimates of cost of construction were submitted to the college, May 8, 1861, but the consideration of these was postponed until the meeting of October. Then, in the debate, objection to beginning the work at that time being urged on the ground that builders' estimates are unreliable, and that the fund was yet inadequate, the plans and estimates were laid on the table for further examination, and the committee continued.

At an adjourned meeting, December 18, 1861, the proposed plan of the hall was approved, a building committee appointed,[4] and instructed to invite proposals for supplying materials and labor requisite to construct the southern part of the

[1] Drs. Fox, Wood, Norris, Paul, and Condie constituted the committee.

[2] Afterwards, January, 1861, a lot on the east of the lot bought was purchased, making the site of the intended building 60 by 110 feet.

[3] The committee appointed consisted of Drs. Hays, Paul, E. Hartshorne, Norris, Fox, and Franklin Bache.

[4] The building committee consisted of Drs. Hays, E. Hartshorne, Norris, Bache, Wood, Fox, and Paul. The three last named were the trustees of the building fund.

building, which covers an area of 78 by 56 feet. The committee was authorized, February 19, 1862, to contract for the erection of this part, and April 2, for the completion of the whole of the exterior according to the plans which include a space of 110 by 56 feet.

The work proceeded, and was so far advanced that the College met in its permanent home for the first time, March, 1863. The building committee submitted its final report February 2, 1864, in which it is stated that the entire cost of the site and building was $40,858, all contributed by members of "our hard-worked and inadequately compensated profession; the whole sum furnished from other sources amounting to only about twenty-five hundred dollars."

The inception of this enterprise is clearly ascribable to Dr. Fox. It was borne in his mind from the date of his first motion, November, 1840, till that of the final report of the building committee, a period of more than twenty-three years; and during more than thirteen years, from the date of his second motion, November 6, 1849, he was actively interested in its execution. He alone did not do it. He had able and zealous coadjutors throughout the work; but it is generally conceded that, from first to last, his tact in affairs, financial sagacity, and alert prudence as well as persistence exercised a guiding and helping influence, essential to the accomplishment of the project, which strengthened the foundation of the College and accelerated the growth of its means of utility.

It may be stated in this connection that prior to the completion of its hall the College occupied rented rooms.

From the time of its organization, 1787, the society held its meetings in the hall of the University of Pennsylvania, then on the west side of Fourth Street, south of Arch Street,

until December, 1792, when an apartment in the hall of the American Philosophical Society, No. 104 South Fifth Street, was leased at a rent of twenty dollars a year, which was afterwards increased. The College continued to be a tenant of the American Philosophical Society till August, 1845. Then more convenient accommodation was obtained on the third floor of the building of the Mercantile Library Company at the southeast corner of Fifth and Library streets. The College resolved to move thence June 7, 1854; and held its first meeting July 4, in the Pennsylvania Hospital building, No. 820 Spruce Street, now occupied by the Historical Society of Pennsylvania, and continued there until March, 1863, when it moved into its new and permanent home.

Dr. Fox was one of the delegates of the College of Physicians to the National Medical Convention which asssembled in Philadelphia May 3, 1847. In the course of the session the organization of the body was modified, and its name was changed to the American Medical Association, its declared purpose being to improve the medical education as well as the efficiency and character of physicians. It meets annually, but two successive meetings are not held in the same place. Dr. Fox was often present at the meetings, either as a representative of the College or of the Philadelphia County Medical Society.

About ten years after settling in premises of its own the College perceived that the rate of increase of the library would render the available room in the building inadequate for its accommodation in the course of a few years. Taught by past experience that gathering a considerable sum by numerous gifts in a small community not many members of which are beyond the need of working daily for support is discouragingly tedious, the College, in order to provide

in time for the coming want, appointed, January, 1875, Dr. Fox chairman of a committee[1] "to devise and report upon a plan for the earliest practicable collection of a building fund, and recommend such measures as may be thought desirable for the improvement of the College property." The committee reported, March 3, 1875, in favor of forming a building fund by appropriating to it all entrance fees and any annual surplus that the College can afford, and also by the encouragement of subscriptions, donations and legacies. The report was adopted April 7. Up to this time about one-fifth of the sum required has been obtained. But the urgency for library space fast outgrows the means to supply it.

December 6th, 1882, Dr. Fox was appointed chairman of the Committee on Finance. The committee met on the 8th and 11th, at his residence, to examine the annual account of the treasurer and the estimates of the several committees asking appropriations. Though his bodily vigor was diminished, he heedfully attended to the work, and expressed his opinions in his usual manner.

Dr. Fox had been a Fellow of the College more than fifty-one years when he rendered his last service to it. During the whole period, its prosperity was a matter of concern as well as a source of pleasure to him. He never declined any duty it imposed, or neglected that of any other society or institution with which he was connected.

In January, 1848, he took an active part in the formation of the Medical Society of the State of Pennsylvania, and was elected its treasurer April, 1848, and declined re-election

[1] The committee consisted of Drs. Fox, J. R. Paul, L. Rodman, Ellerslie Wallace, and I. Minis Hays.

May, 1852. He was frequently present at its meetings as a representative either of the College of Physicians or of the Philadelphia County Medical Society. He participated in the organization of the latter, December, 1848, and at its first meeting, January 16, 1849, was elected one of its vice-presidents, and held the office till January, 1851.

When Wills Hospital for the indigent blind and lame was opened March 3, 1834, he was elected one of the visiting surgeons. Dr. Isaac Hays, Squire Littell, and Isaac Parrish were his colleagues; they were elected at the same time. Dr. Fox delivered here clinical lectures. After fifteen years' service he resigned his position, August, 1849, carrying with him the respect and best wishes of his colleagues. He was at the same time elected a member of the Board of Managers of the Hospital, and served until 1854, when he resigned.

Dr. Fox was appointed surgeon of the St. Joseph's Female Orphan Asylum in 1838. He served the institution sixteen years, and resigned in 1854.

In May, 1848, he was elected one of the visiting surgeons of the Pennsylvania Hospital. March 27, 1854, he resigned the position after nearly six years' service.

Dr. James J. Levick, resident physician, published reports of the service of Dr. Fox in the surgical wards, for August, September, and October, 1849, in the Medical Examiner of October and December. The aggregate of the two reports is 251 cases discharged and 21 died, a mortality of 8.36 per cent. No other published account of his practice in the hospital has been found. In his first report Dr. Levick described a mattress devised by Dr. Fox for the accommodation of patients under treatment for fracture of the thigh, which, he says, "appears to possess many advantages over

those" previously used in such cases. A wood-cut delineation of the mattress is given in the report.

He was regarded as an efficient but cautious operator. His practice in the hospital was considered very successful. His contemporaries ascribe his success to his zealous attention to the minute details of treatment in every case. He manifested great interest in the welfare of his patients, and often visited the hospital at night to ascertain their condition.

Twenty-five cases of various injuries, received in a riot in the southern part of the city, were brought into the hospital during the night of October 9, 1849. Some were fractures of the skull. Dr. Fox made them the subject of clinical remarks which were so impressive that they are still remembered, and the precepts inculcated are still considered reliable in practice by some of those who heard him. It is not claimed, however, that he was eloquent, but that the practical character of his lessons made them instructive and therefore very acceptable. Dr. Fox sought to do well rather than to talk well. In practice he relied upon a rational application of well-known principles, the results of common experience, and his knowledge of therapeutics which, it is said, was admirable. His clinical teachings were conversational in manner, concise, clear, and in matter practical. By merely sketching only some of their prominent features, students had their attention fixed on the cases before them, and were so much interested that they carefully observed them and learned what was done at every step of their progress. They were thus taught objectively what to do and how to do opportunely for patients under different circumstances and learned the methods of modifying surgical appliances so as to adapt them to the requirements of particular cases or of varying conditions.

His participation in the formation and maintenance of the Friday Evening Medical Club, during many years, belongs to his medical history. It was in existence in 1837, and ceased about 1872. The original members were Drs. Thomas D. Mütter, Francis West, Robert Bridges, George W. Norris, Thomas Stewardson, George Fox, William Pepper, Joseph Carson, Edward Peace, Thomas S. Kirkbride, William W. Gerhard, and Caspar Morris, all Fellows of the College of Physicians, and more or less eminent in the profession. Vacancies in the club were filled by a unanimous vote. The purpose of the organization was to promote friendly intercourse among physicians of the city in an inexpensive and simple manner.

The Club met every Friday evening throughout the cool season of the year—from October till April—and each member of it in turn received his colleagues and a limited number of members of the profession invited to meet them at his residence. The entertainment consisted of tea and coffee with hot cakes, rolls, or biscuits, at the discretion of the host, handed to each of the company, which usually assembled between eight and nine, and dispersed about eleven o'clock. Wine and oysters were added to the bill of fare, and the meetings were held on alternate Friday evenings in 1860–61. At these meetings conversation was not restricted to medical topics. They have been held in pleasant remembrance by many, and no doubt enduring and useful friendships had their beginning at those gatherings, which without their influence might not have been formed.

Dr. Fox was elected a member of the Academy of Natural Sciences of Philadelphia, May, 1836, and resigned January 25, 1840. He manifested his interest in the Society by a liberal contribution to its building fund in 1875.

In 1850 Dr. Fox was married "in meeting" to Sarah D. Valentine, of Bellefonte, Pennsylvania, who, with their six children, four sons and two daughters, survive him.

His domestic condition was happy. He often expressed satisfaction that his labors had enabled him to provide means for the comfort of his family. He was firm and strict in the management of his children, but, nevertheless, very indulgent. He was tenderly loved as a brother, looked up to with affectionate respect, living with and taking care of his sisters until his marriage, and subsequently he resided near them and visited them daily.

A very prosperous professional career during nearly a quarter of a century enabled him to relinquish practice in 1854, still in perfect health, and full vigor of body and mind. He retired to a large farm near Paoli, Chester County, Pennsylvania, where he resided three years, and then moved to his place on the Delaware River above Torresdale. There, except a winter sojourn in the city annually, he passed the remainder of his life.

While in retirement in the country he was not quite released from professional work. Until within the last year or two, from far and near, he was frequently called upon for medical advice, which he gave cheerfully and gratuitously. Often he drove miles to visit some sick country clergyman or poor person who sought his professional care.

Such charitable ministrations and the care of his estate and private affairs occupied his time. In January, 1876, he was elected a director of the National Bank of Commerce, and until the close of his life he discharged the duties of the office punctually, and at the appointed times very carefully examined the condition of the bank's affairs.

More than a quarter of a century has passed since Dr. Fox relinquished the practice of medicine. He should be appreciated in connection with the period of his activity. Only a few years before its close anæsthetics were brought into use; he was naturally conservative, and, therefore, perhaps was among those who were opposed to their introduction into the Pennsylvania Hospital. Many instruments are now commonly used to aid diagnosis which were then unknown. Knowledge in every branch of medical science has been more or less increased.

Among his eminent contemporaries in the profession of no better natural endowment than himself were many who were more profoundly versed in medical, scientific, and general learning, more ready with the pen and more fluent in speech, but none who had command of more of the resources of the healing art, or applied them more skilfully than Dr. Fox. He constantly aimed to do the most difficult work in the best way known at the time as the surest and safest for the patient. All his senses that were necessarily employed in observing and discriminating symptoms were well trained, and he was very prompt in reaching a diagnosis and in selecting therapeutic means. In consultation he was highly appreciated on account of his quick and accurate perception, and because he expressed his opinions candidly, and his associates on such occasions were confident that he held nothing in reserve. He was an accomplished general practitioner. Though particularly interested in diseases of the eye, he protested against being called an oculist or an "eye doctor," because he was unwilling to encourage public preference for specialists of any kind.

Anything in the medical or public press in the slightest degree significant of boast or parade of clinical achievement

was shocking to him. His entire freedom from pretension in this sense is seen in the simple titles given to his published papers. In one entitled "Report of cases treated," etc., we have a successful amputation at the shoulder-joint; in another, "Surgical cases," a successful ligation of the femoral artery; and in one called "History of two cases of aneurism treated," etc., we find ligations of the external iliac and of the common carotid arteries, resulting promptly in cure. In his day such grave operations were not as frequent as they are now. His self-respect placed him far above resort to any of those small devices which popularly respected practitioners are sometimes truly charged with employing to create or enlarge a general confidence in their skill, or merely for the sake of that same sort of innocent self-gratification which women are supposed to find in arraying themselves in unusually fine toilets on special occasions.

The general deportment of Dr. Fox truly implied a sincere, frank, cordial, and joyous nature, but being resolute, firm of purpose, a kind of aggressive, abrupt way when opposed, occasionally imparted a harsh tone or roughness to his manner, not at all in harmony with the benevolence and kindliness of his disposition. While on duty in the hospital he was generally forbearing to the resident physicians on occasions when he might have justly chided them on account of imperfectly following his directions.

In business he was punctual and very exact, and expected those who dealt with him to be no less so than himself. He had learned the advantages of employing his time and means economically during his working days.

Dr. Fox died Wednesday Dec. 27, 1882, at 40 minutes past five o'clock P. M. in the presence of his loved and loving family. He had been blessed with vigorous health,

an energetic mind, a collegiate education, and more than seventy-six years of life.

By his frank, straightforward conduct through all those years, and by his faithful work he had deservedly won a high reputation as a practitioner of medicine, most respectful consideration in the community, and the grateful remembrance of those whom he had served professionally.

Through his whole life he had many friends. To use his own words uttered only a few days before his last hour, he was "at peace with all and ready to meet his God."

Speaking of Locke and Sydenham, Dr. John Brown aptly said: "It is the lot of the successful medical practitioner, who is more occupied with discerning diseases and curing them, than with discoursing about their essence, and arranging them into systems, who observes and reflects in order to act rather than to speak,—it is the lot of such men to be invaluable when alive, and to be forgotten soon after they are dead; and this not altogether or chiefly from any special ingratitude or injustice on the part of mankind, but from the very nature of the case. Much that made such a man what the community to their highest profit found him to be, dies, must die with him. His inborn gifts, and much of what was most valuable in his experience, were necessarily incommunicable to others, this depending somewhat on his forgetting the process by which, in particular cases, he made up his mind, and its minute successive steps, from his eagerness to possess and put in action the result, and likewise from his being confident in the general soundness of his method, and caring little about formally recording to himself his transient mental conditions, much less announcing them articulately to others;—but mainly, we believe, because no man *can* explain directly to another man *how* he

does any one practical thing, the doing of which he himself has accomplished, not at once, or by imitation, or by teaching, but by repeated personal trials, by missing much, before ultimately hitting."

This imperfect memory may be fittingly closed with the following brief and accurate statement of some of Dr. Fox's characteristic qualities.

"NATIONAL BANK OF COMMERCE,
PHILADELPHIA, December 30, 1882.

At a stated meeting of the Board of Directors, held this day, upon the President announcing the death of Dr. Fox, the following resolution was offered by Mr. Reed and unanimously adopted, viz.:—

Resolved, That in the death of Dr. George Fox this Board has lost a member whose wise counsels and mature judgment will be missed.

That it hears of the close of his long and useful life with sorrow and regret, and bears testimony to his uniform urbanity, strict integrity, wisdom, and forethought while aiding in the direction of the affairs of this bank.

Further, That this resolution be placed upon the minutes and a copy of the same be sent to the family."

MEMOIR

OF

J. FORSYTH MEIGS, M.D.

By

ARTHUR V. MEIGS, M.D.

[Read March 5, 1884.]

Only eleven years ago my father, Dr. J. Forsyth Meigs, of whose life I am to give you a history, read in this same hall an account of the life of his father. He opened his sketch by telling of the diffidence he felt lest his filial love should tempt him to exaggerate his father's merits, but said further that no one else could have known him as he did. I might well quote the first page of his essay, for it is I believe as applicable this evening as it was eleven years ago, when my grandfather was the subject. The life, however, that I am to picture was a very different one from that which he described.

My grandfather's life was full of excitement and bustle, stirring incident and romantic event. Born on the beautiful and semi-tropical Island of Bermuda, and passing his boyhood in Georgia, a place then upon the confines of civilization, he imbibed many romantic ideas, and the untrammelled life he led strengthened his naturally robust constitution. When less than twenty-one years of age, he came to Phila-

delphia, having borrowed money to study medicine at its famous medical school. Here he made an early marriage, and after living south only a year or two, returned to fight his way to success, surmounting all obstacles, although entirely unaided by any influence, relying alone upon his own strong will, and natural capabilities and assiduity. He did attain the highest possible success then to be reached in his profession. A man of influence in the city, a popular and highly esteemed teacher in one of the most famous medical schools of the day, his name was in every man's mouth, and he long lived an active life, finally to retire, full of years and honors, to a place in the country that he dearly loved, to enjoy there, in the society of his wife, the rest for which he had so long and so arduously labored.

The life I am to chronicle was very different. Few men who attain such enviable distinction as my father, live so quietly, and are so thoroughly out of what is commonly called the world. In his earlier days he was filled, as are physicians of ambition, with the desire to be a teacher, but after my mother's death, which occurred when he was only thirty-eight years of age, a time when most men are only beginning to reach their best success, he withdrew himself from almost everything but the mere practice of his profession. Even his pleasures were set aside, and he practised medicine; first to earn a livelihood for himself and his seven children, and second to find distraction; for his grief at the loss which had befallen him was deep, and he never recovered from it. Naturally a rather sober-minded man, and disposed to look at life from the most serious side, his great loss, which came to him in middle life, made him still more so. As time, however, went by, he found more and more, that what he at first sought as a distraction, and because he considered it

his duty, began to give him pleasure, and almost the only pleasure life at that melancholy time offered. He took the greatest interest in the welfare of his patients, and always gave his best skill and most patient care in every way to advance their interest, and thus tend to gain his end—their cure. He always said a physician should be much more than a mere writer of prescriptions. He was a family practitioner in its noblest and highest sense. His first consideration was always his patient, and after that and far off, came the desire for the other things men strive for—wealth, ease, social position, the esteem of his fellow-men, and that most seductive of all the ends of ambition—fame. Whatever of the latter he attained, was simply the necessary sequence of his conscientious striving after the former. His book was successful and much read, because men came slowly to find that it was the best upon the subject, and he had a large practice, because the community learned that there was no other physician in whose hands they could, with more safety, place the care of their health.

My father was born October 3, 1818, at the corner of Eighth Street and Apple Alley, which is above Race, being the third of ten children. His father was of a New England family, and was in the seventh generation from Vincent Meigs, who was the first of his name to come to America; he settled at East Guilford, Connecticut, about the year 1647. His mother was Mary Montgomery, and she was descended from the old family of the Montgomerys of Scotland. Of his early childhood and boyhood, I have not been able to learn much, for it was a subject upon which he never dilated a great deal to us, his children, and I have not been able to learn from his brothers or sisters of any very striking incidents connected therewith.

From earliest childhood he always wished to be a physician, and from this determination he never swerved, so that in the family there was no question as to what should be his calling. He was a quiet and rather soberly-inclined boy, very fond of reading, and not much given to rough or boisterous play. Without being sick, or positively unable to do all that his brothers could, he was always looked upon as comparatively delicate. His first experience in learning was at a dame's school in Cherry Street. Later he made a very serious step in life, when he went to the Classical Academy of Mr. Samuel Crawford. Many a Philadelphia boy of that day remembers Mr. Crawford, and many remember him with no pleasure. He must have been a harsh and cruel man, for he used his rattan most unmercifully, and few boys passed through his hands without learning the strength of his rod. I think it most characteristic of my father, that, although cruelty was a thing he always hated and despised, yet in his judgment of men he was so mild, and disliked so much to think harshly of any one, that he never admitted Mr. Crawford had been cruel. He always said the terror of the rod he saw so freely applied to almost all the other boys, but of which he himself never experienced the lightest touch, was good for him, and drove him to study hard, harder than he would have done had he not ever had the fear of the rattan hanging over him. "It was seldom used," he would say, "unless in some way deserved."

When not sixteen years of age he was taken from school, and began the study of his profession, attending the lectures upon two of the elementary branches at the University of Pennsylvania, and at the same time studying music, and having a tutor who gave him some further instruction. He studied four years at the University, and graduated in

1838, when not twenty years of age. At about this time he went to Georgia to pay a visit to Mr. John Forsyth, who had married his aunt, and after whom he was named. The journey was at that time a much more difficult undertaking than it is now, for railways had not yet superseded the old way of travelling by stage.

While still at college he was elected to the position of resident physician in the Pennsylvania Hospital, and went there almost immediately after his graduation on the first of April, 1838. Here he had for his colleague and room-mate, during the first year of his residence, Dr. Henry H. Smith, since Professor of Surgery in the University of Pennsylvania. His colleague during the second year (the term of service was at that time two years) was Dr. Alfred Stillé, now Professor of the Theory and Practice of Medicine in the University. When he entered the hospital he was less than twenty years old, and he has often told me, in later years, when I have myself been in difficulty, how he felt and feared his responsibilities at that time, how on more than one occasion, when summoned to attend an injured person, just admitted to the ward, he would, after the nurse was out of earshot, cry out in despair, "I cannot, I cannot;" but calming himself externally would discharge his duties, no one ever suspecting how much it cost him. He also told me that, upon one occasion, he became enraged at a patient, and losing all control of himself, danced about the ward, and swore at the man furiously. For this he was reported by some one to the managers of the hospital, and was summoned to appear before the two attending managers, two solemn members of the persuasion of Friends, in broad-brimmed hats, and was given a severe reprimand for his unseemly conduct. When he finished this story he always

laughed, and said the rebuke did him good. Much is said nowadays of the cruelty of officers and officials of institutions to the inmates, but the great provocation that has constantly to be endured with the class of people who form a large portion of the inmates of charitable institutions is seldom remembered. When so gentle and habitually considerate and kind a man as my father could so completely lose his temper, it is hardly to be wondered at that most men are occasionally cruel.

I cannot better picture my father as he was at this time, and earlier, during his student life, than by quoting from a letter kindly written me by Dr. Stillé. He says, "When I saw him on the benches of the lecture-room at the University . . . . I did not at first know his name, but I wondered at such an immature boy, as his appearance showed him to be, being engaged in a study that demanded all possible preparation by mental maturity and cultivation. And this deficiency, if he did not realize in itself, he certainly did feel after I had the pleasure of being his associate in the Pennsylvania Hospital. In the interval of three years, however, he had become a man, physically and mentally, although the development did not efface in him that certain feminine delicacy, in both respects, which was no doubt natural to him. I never knew a more modest man, one who, without being squeamish or puritanical in the least, was more delicate in his language and conduct. I think that no one else could have the same right to speak of this as I who shared the same room with him for a whole year, and who for many years afterwards saw more of him than perhaps any other medical friend. . . . . I had myself gone abroad imbued with the enthusiasm of Gerhard and Pennock, who first brought to Philadelphia the methods of

study of the Parisian school, and I, in my turn, excited the ambition of Dr. Meigs to become acquainted with them. I remember the deep interest he manifested in my exposition of the methods of examining patients, of recording cases, and of numerical analysis. And although I cannot now remember that he carried it into practice while with me in the hospital, I know that he did so afterwards. I think I can see him now sitting cross-legged upon his bed as naturally as if he had been a born Oriental, and conversing with me upon these and similar topics, always grave but never solemn; always earnest but never enthusiastic, having a single eye to learn the truth, whatever it might be. Like other young men so thrown together, we fell into many discussions of topics in no way related to medicine, and canvassed them diligently, but never with acrimony even when our notions disagreed; and I confess that I had often to wonder at the simplicity, naivieté, yes, innocence of his character. . . . . I hardly remember a happier year of my life than the one spent as the colleague of Dr. Meigs, and that he too found it agreeable seems to be shown by the fact that our friendly relations continued as long as he lived. I lamented the termination of his hospital term of duty (at that time it was for two years), but our intercourse was maintained by letter during his residence abroad, and I know very well that his correspondence was always entertaining. I have to regret that of all his letters to me the only one that has been preserved I have placed in your hands, but I distinctly remember that they had very little relation to medical affairs, because the fact surprised me at the time. His foreign tour, however, did much for maturing his character, and ridding it of that provincialism for which untraveled Americans are notorious. On his return he, of course, found

a comparatively straight and easy road to professional success before him. His father's name was a tower of strength, and from it he went forth to do battle with disease among the infants and children of his father's families. More than once, in later years and before he reached middle life, he has lamented to me that he was too much hemmed in by pædiatry. Yet in this he laid the strong foundations of his professional success. All the while he was collecting the material for the work upon which his reputation must chiefly rest. Every case was recorded, and by degrees a mass of material accumulated that formed a mine out of which at last was built up his work upon diseases of children. From time to time he conversed with me about these papers, read them to me for criticism, and finally, taking Rilliet and Barthez as his model, he produced the best and most original work upon the subject in the English language."

I have quoted Dr. Stillé's letter thus at length, because it shows better than any words of my own how my father appeared, during the earlier portion of his medical career, to that one of his contemporaries who, from their intimacy, was best able to judge him. Almost immediately after finishing his term of service at the hospital he went to Europe, sailing in April, 1840. While abroad he spent some six or seven months in Paris, where he further pursued the study of medicine. He never said very much about his life in Paris, but did tell me once, that at that time his studies were rather in the direction of surgery, as his father and he had concluded he was to be a surgeon. He listened while in Paris to the teachings of Velpeau, Louis, and other eminent French physicians of that day. While abroad he visited Italy, Switzerland, France, Belgium, and parts of

England, going east as far as Warsaw and Vienna, and south as far as Naples. This was before the days of railroads, and almost all his travelling was by diligence.

In August, 1841, he returned home, coming back as he went, in a sailing vessel, and then his life opened in earnest, as he began the practice of his profession, in his father's house in Chestnut Street above Tenth. His father's name and influence secured for him an introduction, and from the very beginning he had more or less practice.

In the spring of 1843 he began his career as a teacher, delivering an introductory lecture to his course upon Obstetrics on April 6th, at the Philadelphia Association for Medical Instruction. The lecture delivered upon this occasion, which was his first appearance before an audience of any sort, was very characteristic of the man and of his wonderful love of truth. He begins, "To-day for the first time in my life I appear before an audience in the character of lecturer. It is to me, as you will readily believe, a moment of deep and intense interest. My position at this moment is like that of some adventurous traveller in distant lands, who, standing upon the confines of a new and unknown region, into the hidden recesses of which he is about to plunge, will naturally pause," etc. etc. How few men, when beginning their career as speakers, open by announcing to their audience that they are new to their position! The Medical Association was intended to give instruction to the students during the spring and autumn, supplementary to the regular courses of lectures, at the different medical colleges in the city. In this institution my father was associated with the late Drs. Joshua M. Wallace, F. G. Smith, John McClellan, and Robert Bridges, and Drs. Alfred Stillé, Keating, and various others. He delivered courses of lectures at different times upon

Obstetrics, Diseases of Children, and Practice of Medicine, and the association must have continued in existence until 1854 or afterwards, a period of eleven years at least. During this time my father was most assiduous and active, if one may judge by the number of written lectures and notes found among his papers which were prepared for this institution. He was a most conscientious worker, and in his lectures speaks constantly of his efforts to do well. An examination of these lectures shows that even at that early day, his mind had already become impressed with many ideas which in after years became even more firmly fixed. For instance, he devotes almost the whole of his general introductory to the course of 1850 to a consideration of "Habit and its Effects," enjoining the formation of good ones, and the avoidance of bad, and impressing upon his hearers how wonderful is the effect of habit upon man, and how impossible it is to escape from its effects if once established. In a lecture upon typhoid fever he says, "Diet is exceedingly important, nothing more so." He gives an analysis of cases treated in private practice, and in a series of sixty-nine reports five deaths, and records that in five instances more than one case occurred in the same house. A much less mortality than the ordinarily quoted hospital statistics would lead us to expect. He mentions the occurrence of relapses in the disease, and that the fever attacks very young children, facts which have only come to be generally acknowledged very lately, although he made his observations and taught them more than thirty years ago.

On October 17, 1844, he was married to Ann Wilcocks Ingersoll, who died a little more than twelve years afterwards, December 30, 1856. They had eight children, the oldest and youngest of whom died young.

In the spring of 1845, my grandfather went to Europe for his health, leaving my father to take charge of the greater part of his patients. From this time, although only twenty-six years of age, he had a large practice.

In 1858 was published the first edition of his book upon Diseases of Children; it appeared as one of the "Medical Practitioner's and Student's Library." This work soon established for itself a reputation, although of course it elicited some share of adverse criticism. My father often quoted one critic, who said, "Dr. Meigs has rushed in shirtless haste before the public," and the recollection of this mistaken estimate of his work always amused him. A second and third edition were soon exhausted and the book was allowed to go out of print. In 1869, finding himself so much occupied that there seemed no prospect of his being able unaided to prepare a fourth edition, he associated with himself Dr. William Pepper, giving him a full half ownership in the book and changing the title to Meigs and Pepper on Diseases of Children. One of the most marked traits of my father's character was shown in his thus placing upon equal terms with himself, who had written a book with an already established fame, so young a man, at that time just entering upon the practice of medicine, although he has since taken so high a position in the profession, and whom he conjoined with himself that he might have some one to do the laborious parts of the work which he was himself unable, from his excessive occupation, to accomplish. In 1870 the fourth edition appeared under the new title. Further editions of the book were from time to time called for, and the seventh and last appeared in 1882, less than a year before his death. During all this period of thirty-four years the book maintained the position which it took almost

from the beginning, as the best work upon the subject in the English language.

As a writer, he perhaps never did himself full justice, for after the publication of his book, which was the great literary labor of his life, he undertook no work of magnitude, being incessantly occupied with practice. He wrote only when he felt absolutely driven to give to the world something which burned within him, and which he thought of such importance that he at all costs seized the time to commit it to paper. The literary instinct was strong within him, and his mind and memory were stored with conclusions and observations the result of his great experience. Nothing but his excessive occupation prevented his being a voluminous writer, for he wrote with great ease and rapidity, and was very fond of literary work, never seeming more happy than when seated at his table with paper before him, and surrounded with books.

That he was capable of other literary productions than the mere detail of medical observations, to which he usually confined himself, is shown by his memoir of his father, Dr. Charles D. Meigs, which is a very graceful tribute of a son to a father, and is besides a very charming and just piece of biographical writing. During his life he contributed a number of articles to various medical journals, some of them being of great importance and originality, as for instance, "Remarks on Atelectasis Pulmonum, or Imperfect Expansion of the Lungs, and Collapse of the Lungs in Children;" "Heart-clot as a cause of Diphtheria;" and "On the Morphological changes in the Blood in Malarial Fever, with Remarks on Treatment." He also wrote the "Address on the Opening of the New Lecture and Operating Room of the Pennsylvania Hospital;" "Memoir of Charles D. Meigs,

M.D.;" and "A History of the First Quarter of the Second Century of the Pennsylvania Hospital."

My father was, however, so incessantly occupied with the cares of practice that he took but little time, either for literary work, which was always a great pleasure to him, or for leisure. This is well shown by a letter he wrote to Dr. Stillé, then abroad for his health, in 1851. He begins: "I am quite afraid to say how long since it was that I received your letter dated at Vienna, for I am perfectly aware of how abominable it has been in me not to have answered it long ago. My excuses, not my excuse, must be, that I have been incessantly, and necessarily occupied. In fact, I have never been so busy in my life as I have been during this whole winter and spring. My business has been very urgent, for I have been paying from eighteen to twenty-six and twenty-seven visits daily the whole winter, and during my father's absence of four weeks at the South, I was literally overwhelmed and half murdered. My lectures, too, in your old position, have been constantly digging me in the side—screaming at me with the voice of a locomotive whistle, work, work, rest not—so that you must really believe that my not answering your welcome and agreeable letter before this has been the consequence of a pressure of matters that must have the precedence of all others. . . . . .

"You have heard, no doubt, of the death of poor ——— He died of meningeal apoplexy, and was found to have been laboring under enlargement with softening of the heart, and to have his right lung greatly reduced in size from the pleurisy he had had some two years before his death. So that the poor fellow had been practising hard, writing on scientific subjects, and discussing unity of races with Bachman, for two years with but one lung. If he had rested

himself, as he ought to have done, and as he would have done had he been anything but a doctor, he might have been living still in very tolerable health. But doctors must work and toil, when all other professions would rest from labor, and so he lost his life. . . . . .

"How do you feel about returning home to toil and strive? Does not your heart sometimes sink at the thought of submitting again to the fatigues and thousand annoyances of medical business? Upon my word, I often think that if I had but some two or three thousand dollars a year, I would spend the coming fifteen or twenty years of my life at Geneva, or in Florence, reading language and educating my children—but then comes the thought, educating my children—for what? To come home to this hard-working, bustling, driving nation. How little fitted would they be to fill their stations in life did they see me lounging listless and inactive through my life! No, I must work even to set them an example, as well as to obtain for them food, raiment, and lodging." This shows the life he led at that time, and the effect it had on his mind and spirits.

In December, 1854, he had a severe attack of pleurisy or pneumonia, which threatened his life. After a short holiday, however, he went to work again as hard as ever.

In December, 1856, my mother died, and he then plunged himself, if possible, deeper than ever in the vortex of labor, seeking distraction.

In 1859 he was elected one of the physicians to the Pennsylvania Hospital. The duties connected with this position were a constant pleasure to him, so long as he continued to hold it, which he did for nearly twenty-three years, and he took an interest in the hospital, not as physician alone, but in its welfare and prosperity in every way. He was the

means of getting large sums of money donated at different times, and this fact, as well as his long and faithful services as physician, is mentioned in a series of resolutions passed by the board of managers, when he resigned his position in November, 1881. He wrote, "A History of the First Quarter of the Second Century of the Pennsylvania Hospital," which was read before the board of managers at their stated meeting, held 9th mo. 25th, 1876. His term of service as physician was in the summer and autumn, when he was least occupied with practice, and he took the keenest interest, both in his work in the wards, and his lectures to the class, which were, during all the earlier portion of the time he was connected with the hospital, continued throughout the whole summer, two lectures being given each week. He had a wonderfully quick and incisive way of examining patients, and would often by one or two questions rapidly put, elicit facts that his clinical clerk and resident physician had failed to learn after long and laborious cross-questioning. The rapidity and precision with which he would make a diagnosis were thus often a cause of astonishment to those following him in the course of his duties in the wards. He never seemed to pass by or to neglect any patient under his care, no matter how chronic or disagreeable the nature of the complaint might be, giving to each one the due and necessary amount of time and attention. He was uniformly kind to all his patients, and ever kept before him, as his first object, the cure or alleviation, so far as might be possible, of their various maladies, never losing sight of this object in the pursuit of any scientific investigation in which he might be engaged, and during his whole time of service as a hospital physician, he was much occupied in scientific investigation,

constantly striving to add to the stock of our exact knowledge.

When the great civil war broke out in 1861, it found him and all his family, by inheritance, members of the Democratic party. His father had lived in Georgia, and naturally he and all his sons were Democrats. My father was the first of the family to turn to the other party. I have often heard him say that before the election of Mr. Lincoln, he had thought and read much, trying to learn what would be right for him to do, and even the day before the election was still uncertain. That evening he went to consult Mr. Horace Binney, who was one of his warmest friends, upon some of the law and historical points connected with the matter, and after hearing Mr. Binney's answers to his questions, went home determined to vote for Mr. Lincoln, which the next day he did.

It was in my father's office that the scheme for the establishment of the Union League of Philadelphia was matured. This important organization, which was political in its purposes, was the first of its kind to be instituted in the country, those of New York and other cities being established afterwards, and in imitation of that of Philadelphia. It grew out of the Union Club which was organized in November, 1862. The following extract from a book entitled "Proceedings of a Meeting of the Union Club of Philadelphia, held at the League House, December 27, 1870," Phila., J. B. Lippincott & Co., 1871, page 25, will show this: "The seventh meeting of the Union Club was a memorable one. It was held at the house of Dr. John F. Meigs, on the twenty-seventh day of December, 1862. At this meeting the scheme for the establishment of the League was matured, and the articles of association for that purpose were first

read, and they were afterwards generally signed by the large company present. During the first year of the existence of the club, Dr. Meigs' professional engagements compelled him, to the regret of all, to resign his membership, and therefore his name appears nowhere upon the roll of the Union Club which was subsequently printed. He was not the less one of our earliest and most active members." Throughout the war he continued to be most earnest in his support of the government, and looked forward to the possibility of a disruption of the country as almost certain ruin. So unnecessarily anxious, as the event proved, was he lest the government should fail to quell the rebellion for want of funds, that he at one time seriously contemplated having all his family silver melted into money to be given to the government, and I remember the silver being all brought home from the bank and weighed preparatory to the execution of this purpose, which, however, was never carried into effect.

In December, 1863, he had a second attack of pneumonia with hemorrhage from the lung, but within a very short time he recovered and returned to his practice.

In 1864, my father applied for the then vacant professorship of the Theory and Practice of Medicine in the University of Pennsylvania, but he made no canvass for the place, and was only half-hearted in his desire to be elected. He received, however, several votes, although Dr. Stillé was elected.

Dr. Meigs was a man endowed by nature with a rare and seemingly contradictory combination of qualities. He could be bold to temerity, although usually he seemed a timid man; he was gentle as a woman, and yet could be almost fierce, and absolutely unbending, if roused concerning

things he thought important. He made few friendships except such as came to him through his professional relations; to ties thus formed, he was ever most loyal. It was in this manner that his friendship began with the late Mr. Horace Binney. They were firm and fast friends for many years, and it was only Mr. Binney's death that severed the tie.

A deep and lasting effect was produced upon him when a boy, by seeing his mother at the head of the family of a struggling and rising physician. The family was a large one, for his parents had ten children, and the mother's life was one of constant occupation with little leisure. The sight of this, together with the effect produced upon my father's then impressionable nature, by the stern discipline that was maintained at Mr. Crawford's school, where he was obliged to study almost unceasingly, lest he too should be whipped, must have been large factors in forming the bent of his mind. Throughout life he was always deeply impressed with the wonderful and lasting effects of habit, once formed and firmly established. He himself formed, very early in life, the habit of unceasing labor, and although the original motives were gone, the fear of Mr. Crawford's rod, and the desire to do all he could to spare his overtasked mother, yet the habit was firmly fixed upon him, and he never escaped from it. This turn of mind made him sometimes impatient in his judgment of innocent pleasure; it was not that he thought pleasure itself wrong, but he had ever before him the fear lest it should lead astray from the paths of good conduct, and this fear pursued him like an ugly shadow, and interfered with his enjoyment of his own hard-earned moments of leisure, which were ever darkened by the dread that he was unduly prolonging them when he should be back again in his tread-mill.

In his use of medicines he habitually gave small doses, and appeared ever fearful of producing ill effects, but on occasion, when prompt action seemed necessary, he would give drugs, and doses of them that other men dared not. He always seemed to me singularly skilful and happy in his treatment, concluding to do, by what seemed an inspiration, exactly the thing needful at the moment. He was strongly impressed by, and thoroughly knew when to apply the rule, which he used to attribute to the late Dr. Parrish, "when you know not what to do in medicine, do nothing," appreciating fully that there are times when we must stand helplessly by and wait, trusting for the while to the *vis medicatrix naturæ*. He well understood that most diseases tend spontaneously toward recovery, and knew when to apply this knowledge.

With his patients he was ever gentle, giving much attention to their account of themselves and their condition, and in his diagnosis and prognosis giving generally the first place to a consideration of what Stokes has well called the "vital phenomena," and afterwards and secondarily considering the physical signs. Of all things he hated a quarrel, whether it resulted in words or blows, and I do not remember his ever being engaged in one. Although this was true, he seemed incapable of fear, either physical or moral, assuming his responsibilities as they met him, or going out to face them with a calm and immovable front, whatever his inward sufferings may have been, and they must have been great, for after all he was naturally a timid man, and it was only his wonderful moral courage that enabled him to triumph over his disposition.

I well remember in my early student days going to the Pennsylvania Hospital to follow him in his rounds

through the wards. Arriving there one morning, I found a great excitement within the usually quiet old walls. Around one of the basement windows, which was barred, I saw a crowd of men and women, and heard a voice occasionally crying out inarticulately. Approaching, I saw a man in one of the cells careering wildly around its narrow limits, beating the sides with a heavy brass instrument. Saliva ran from his mouth in streams, so that it lay in pools upon the floor, and the walls were bespattered with it. I shall never forget the terror-stricken faces of those around the window, and how they stood far away and looked. They told me the man had hydrophobia. The resident physician and nurses were terrified, and no one dared go in, to quiet the raving man. Presently my father came, and learning the situation, quietly directed that a mattress be brought to him, and then, finding one of the nurses who was willing to accompany him, opened the door, and holding the mattress so as to protect himself from any blow, he and the nurse entered, and forced the raving man to lie on his bed. While effecting this the man spat full in his face and eyes; nothing disturbed by knowing that this quantity of one of the most dreaded poisons was upon him, my father quietly finished what he had to do before washing his face. I remember my terror when I learned what had happened, but he did not seem in the least disturbed, and I never heard him mention it afterwards, although most men would have been long haunted by a fear of hydrophobia. He never seemed to have the slightest fear of any contagious disease, and would frequently inveigh against the modern terror of scarlet fever, and belief in its virulent contagiousness. He always maintained that it was very slightly contagious, much less so certainly than measles, and that the present

custom of ostracizing any family where there might be a case, was cruel and barbarous, besides being cowardly and useless.

With all his gentleness and hesitation ever to think harshly of others, he was sometimes very severe in his judgment of things he disapproved of, or could not sympathize with, although they might be harmless in themselves. He had no hobby, and his life was a much less pleasant one for the want of it. Although fond of books and a great reader, and having a great love for boats and the water, and seeming to have a taste for zoology, besides taking a more than passing interest in many other things, he never let any one of them take a strong hold upon him, but devoted himself with real assiduity to his profession only, taking in a little of the other things from time to time as they came in his way. It was for this reason partially that he never made any serious preparation to retire from his professional labors, although he had talked of it for many years, and always looked forward to the time when he would live a life of leisure. At times he would become excessively weary of his life of constant labor, and yet when he contemplated the prospect of having no perfunctory work, he feared lest the time might hang heavily upon his hands. He had a great love for literary work, and at times pictured himself as retired from active practice, and occupied in writing of his past medical experiences, which were very extensive.

During the last four or five years of his life he allowed himself a little more leisure, taking each summer six or eight weeks, during which he travelled off to some out-of-the-way place where he thought he would be unlikely to be troubled by calls upon his professional skill, for he never could refuse

a request for advice; but when at home he worked as hard as ever, denying no one, and going at all times and in all seasons to any one who asked him.

On December 9, 1882, he paid his last professional visit. For two or three days the weather had been very cold and bleak, and he had been constantly chilly, and then had pain in the chest, which on the afternoon of the ninth was very severe, but still he insisted upon going out. About six in the evening he came home, and the pain was so intense that he was obliged to go to bed. In a day or two he had a fully developed pneumonia, and after suffering absolute anguish from diaphragmatic pleurisy with which it was accompanied, he died on the afternoon of December 16, an hour or two less than a week from the time when he paid his last professional visit.

How he was beloved and mourned is evidenced by a notice of his death which was written by an old friend and patient, and which expresses better than any words of mine could the sentiment of the community at his loss. "The announcement of the death of Dr. John Forsyth Meigs, upon Saturday evening, cast a deep shadow of gloom over a very large circle of Philadelphia society. Born, bred, and living his life of active usefulness in this city, Dr. Meigs had gained so strong a hold upon patients, friends, and the public at large, that the sudden news of his loss falls as a sharp and heavy blow. Of the thousand families among whom his work of professional beneficence has been done, there is hardly a member who has not learned to love and to revere him. Untiring in effort, prodigal of his time and strength, and bringing to the treatment of every case the highest skill, the most minute attention to details, the most earnest resolves to succeed, Dr. Meigs could not fail to

impress himself strongly upon all affections and judgments. He was one of those faithful physicians for whose coming the waiters in the sick-room ever eagerly watched. The careful notation of the most apparently trivial symptoms, his honest statement of opinion, his genuine expression of sympathy, all inspired the strong confidence that what was being done was the best that human skill could accomplish.

"A patient and correct thinker, not only upon the professional subjects which so largely occupied his attention, but also upon subjects of wider or more general interest, an accurate writer upon several branches of medical science, an actively good and patriotic citizen, Dr. Meigs' domain was the sick chamber, his sphere was the contest with the enemy ever springing for his prey, which the follies, the ignorance, and the misfortunes of humanity keep in unceasing activity. In this field he was ever battling, mostly successful, sometimes baffled and disappointed, but always retiring with the consciousness of having fought the good fight, and of having struggled manfully for victory. He has been taken from life whilst actively engaged in the exercise of his noble calling, and his last earthly thoughts, his last wandering fancies reverted to those to whom he had always given good measure, pressed down and running over. Long, very long will it be before the medical profession will produce a more perfect model than this gallant, modest, unselfish, blameless, civic hero."

MEMOIR

OF

SAMUEL D. GROSS, M.D., LL.D., D.C.L.,

EMERITUS PROFESSOR OF SURGERY IN THE JEFFERSON MEDICAL COLLEGE OF PHILADELPHIA.

By

I. MINIS HAYS, M.D.

[Read July 2, 1884.]

In the history of American medicine, in the long list of names of men who have been especially distinguished by their valuable contributions to the science and art of surgery, we find two who are conspicuously pre-eminent, and upon whom, each alone in his generation, has been conferred by general assent, the honored title of "The Nestor of American Surgery." Of the two, Philip Syng Physick was gathered unto his fathers nearly half a century ago, and to-day we mourn the loss of Samuel David Gross.

Dr. Physick, although a surgeon of great learning and brilliant capacity, added but little to the literature of our profession, and he left his impress upon American surgery chiefly through the fading tradition of his teachings. But Dr. Gross was, in addition, an industrious and voluminous writer, and has left a precise and imperishable record of his profound study and vast surgical experience.

Dr. Gross was born near Easton, Pennsylvania, July 8, 1805. He received a classical education at the Wilkesbarre Academy and at the Lawrenceville High School, both famous institutions in their day, the former having been under the charge of Mr., afterwards Judge, Joel Jones, a graduate of Yale College, and the latter having been presided over by the Rev. Dr. Isaac V. Brown, an alumnus of Princeton College. At the age of nineteen he began the study of medicine, first under Dr. Joseph K. Swift, of Easton, and subsequently with Professor George McClellan, the eminent surgeon of Philadelphia. He graduated from the Jefferson Medical College in 1828, and immediately began practising his profession in Philadelphia. During the first ten months of his novitiate, to fill up the intervals of practice, which came but slowly, he translated from the French and German, Bayle and Hollard's General Anatomy, Hildebrand on Typhus Fever, Hatin's Manual of Obstetrics, and Tavernier's Operative Surgery, for which he received eight hundred and seventy-five dollars. In 1830, or two years after his graduation, he published his "Treatise on the Anatomy, Physiology, and Disease of the Bones and Joints," in which he called attention to the employment of adhesive plaster as a means of extension in fractures of the lower extremity, a method of treatment almost universally in vogue at the present day.

After the lapse of eighteen months, having in the meanwhile married, and his patrimony being almost exhausted, Dr. Gross returned to Easton, where he soon acquired a good practice; and when he left for Cincinnati, in October, 1833, two years and a half afterward, he was regarded as the most learned practitioner of the place. To increase his knowledge of practical anatomy he erected at the foot of his gar-

den a dissecting-room, and he brought his first cadaver in a buggy from Philadelphia, but he subsequently obtained material nearer home, not, however, without incurring great risk of detection. He dissected and performed the more important operations on the cadaver several hours daily, and in this way obtained a vast amount of information which proved of the utmost value to him in subsequent years. All his leisure hours in the summer were spent upon the composition of a work on descriptive anatomy, which was, however, never completed. The MS., still in existence, contains, it is believed, the first effort in the English language to change the nomenclature of anatomy from Latin into English, a plan which, at his suggestion, was afterward adopted by his pupil, Dr. T. G. Richardson, now Professor of Surgery in the University of Louisiana, in his work on Anatomy, and subsequently by Professor Leidy, of the University of Pennsylvania, in his text-book on Anatomy.

During his residence at Easton, Dr. Gross made a series of observations upon the temperature of venous blood—altogether fifty in number—mostly of healthy persons, and found the average to be 96° Fahr., the maximum being 104°, and the minimum 92°. Hence, he regarded the average of 98°, as usually stated, as too high. The results of these investigations were published at Cincinnati in 1835, in the second volume of the *Western Medical Gazette.* He also noticed in these observations a singular phenomenon, then, if not still, unknown, that if the arm be tied firmly for five or six minutes before opening the vein, the temperature of the blood which flows during the first thirty or forty seconds will be several degrees lower than that which issues subsequently, a fact which is probably due to the stationary condition of the blood in the veins. In addition to these

experiments, he conducted others upon excretion to ascertain the rapid transit of certain articles, when taken into the stomach, through the blood to the kidneys. For this purpose he selected rabbits, to which, after having tied both renal arteries, he administered protoxide of iron. The animals were killed within fifteen to thirty seconds, and upon applying a solution of cyanide of potassium to the urine in the bladder, ureters, and kidneys, well-marked traces of iron were invariably found in that fluid. To those who remember the doctrine of solidism, so dominant in the schools of those days, these investigations are not without their significance. Another experiment which interested him at this time very much was the inoculation of a cat with the virus of smallpox, the object being to ascertain whether Gendrin was right in asserting that the disease could be communicated in this way to an inferior animal. With the exception of slight suppuration, no ill effects followed.

In 1833 he performed a series of experiments upon rabbits with a view of throwing light upon manual strangulation, a full account of which was published in the ninth volume of the *Western Medical and Physical Journal*, and an abstract of which will be found in the second volume of Beck's "Medical Jurisprudence," with appropriate comments by that distinguished author. Shortly before these experiments were made, Dr. Gross was the chief medical witness in the case of Goetter, which constituted the most important event during his professional life at Easton. Goetter had killed, by manual strangulation in the eighth month of her pregnancy, a woman whom he had seduced. Dr. Gross made the post-mortem examination, but neglected to open the skull, and on this account was subjected to considerable annoyance during the trial, as the defence partly rested upon

the ground that the woman had died of apoplexy. It was evident, however, from the marks upon her neck, and the condition of the face and lungs, that she had died from asphyxia, and he gave his testimony accordingly. The man was convicted solely upon circumstantial evidence, but the day before his execution he confessed that he had choked the woman to death with his hand.

In October, 1833, Dr. Gross, after having been offered the chair of Chemistry in Lafayette College, Easton, removed to Cincinnati to accept the demonstratorship of anatomy in the Medical College of Ohio, and here he commenced his career with a hundred and fifty dollars in his purse. His first class numbered nearly sixty out of a total class of about eighty-six. He gave regularly three lectures a week, chiefly on surgical and visceral anatomy, kept the rooms well supplied with subjects, and thus laid the foundation of the study of practical anatomy, which up to that time had been merely nominal in the Western States. In the spring and autumn he delivered private courses to small classes, earning little money, but accumulating valuable knowledge, and acquiring reputation as a zealous anatomist and a successful teacher.

Dr. Gross remained in the Medical College of Ohio only two sessions; when, in 1835, he was unanimously elected to the chair of Pathological Anatomy in the Medical Department of the Cincinnati College. During the first few years after his appointment he abandoned himself almost wholly to a special course of study to aid him in the discharge of his official duties. His medical friends did all they could to obtain for him post-mortem examinations, of which full notes were always taken, and the specimens preserved. In this way he laid the foundation of a museum of morbid anatomy,

which, when the college was broken up, four years after its organization, contained a large number of valuable preparations.

It was from these dissections, from an elaborate course of reading, and from numerous visits to the slaughter-houses of Cincinnati, that Dr. Gross derived the knowledge upon which was founded his "Elements of Pathological Anatomy," issued in 1839, in two octavo volumes of upwards of five hundred pages each. The book was illustrated by numerous wood-cuts and several colored engravings, and was the first systematic work upon the subject ever published in the United States, or, indeed, in the English language. A second edition, greatly enlarged and thoroughly revised, was issued in 1845, in one large octavo volume of eight hundred and twenty-two pages, profusely illustrated, and full of marginal references, which greatly enhanced its value as a learned work. The third and last edition appeared in 1857, and in its preparation, especially the microscopical portion, the author was assisted by Dr. Da Costa. The work, in its original form, cost Dr. Gross, who had no one to advise or guide him, much labor and anxiety, having been written in the intervals of a large and increasing practice, during hours often snatched from sleep, and under the exhaustion of fatigue, upwards of three years having been spent upon its composition. That he had not labored in vain was indicated not only by the reputation, both at home and abroad, which his researches in this branch brought him, but by an incident which was peculiarly gratifying to him. In July, 1868, Virchow had invited a number of prominent men to meet Dr. Gross at his residence in Berlin, among whom were Von Langenbeck, Von Graefe, Donders, and Gurlt. Toward the conclusion of the dinner, the host,

availing himself of a lull in the conversation, drew forth a large volume from under the table, and, rising, took Dr. Gross by the hand, and made him an eloquent address, complimenting him upon his labors as a pathological anatomist, and referring to the book, which happened to be the second edition of his "Elements of Pathological Anatomy," as one from which he had derived much useful instruction, and one which he always consulted with much pleasure. It need not be said that the author was deeply flattered by this great honor, so unexpectedly and so gracefully bestowed upon him by the great German pathologist. This estimate of the value of his work was more than compensation for all the toil and anxiety which it had cost him.

While engaged in the preparation of his "Pathological Anatomy" Dr. Gross contributed numerous papers to periodical literature, instructed a number of private pupils, attended to a large general and consultation practice, and never missed a lecture. In 1839 he was unanimously appointed Professor of Medicine in the University of Virginia, a compliment the more honorable because it was unsolicited on his part, and a short time previously he had been offered the Chair of Anatomy in the University of Louisiana. These offers were promptly declined; and it was well that they were, as a far more important position awaited him. During the spring of 1840 he accepted the Professorship of Surgery in the Louisville Medical Institute, afterwards the University of Louisville, which had been rendered vacant by the resignation of Dr. Joshua B. Flint. The most distinguished members of the faculty of this school at that time were Daniel Drake, Charles Caldwell, John Esten Cooke, and Jedediah Cobb. Dr. Gross was the youngest member of the faculty; and although he had never taught

surgery, he was thoroughly acquainted with its principles and practice, and had no misgivings upon entering upon the discharge of the duties of the chair. As a teacher he had never known what failure was, and he felt certain that he would succeed in his new field of labor. The class, during the first winter of his connection with the school, numbered two hundred and four, from which it afterwards increased to four hundred and six, the largest it ever had. As there was no rent to be paid for the building, the net proceeds of each chair amounted for quite a number of years annually to nearly $5000.

The government of the University of Louisville was invested in a board of trustees, who were self-appointing. In 1849 an attempt was made by the city of Louisville, through the Supreme Court of Kentucky, to wrest the control of the school from the hands of the men who had so ably managed its affairs, and to make the board elective by the people. At this particular crisis, being in doubt as to how the suit would terminate, Dr. Gross accepted the offer of the Chair of Surgery in the University of the City of New York, rendered vacant by the retirement of Valentine Mott, his colleagues being Granville Sharp Pattison, John W. Draper, Gunning S. Bedford, Martin Payne, and Elisha Bartlett, all men of distinction and ability. Dr. Gross was then forty-five years of age, full of ambition, and determined to do full justice to his chair. He passed the winter of 1850–'51 in New York; but, long before the termination of the session, he was solicited by his late colleagues at Louisville to resume his chair in its University, the suit in the mean time having been decided in favor of the board of trustees. Dr. Gross found that the University of New York was then unpopular with the profession of that city, that the college edifice was

ill-adapted to its objects, that living and rents were exorbitantly high, and, in short, that the prospects of the institution were not such as, in his opinion, to render it desirable to continue his connection with it. These considerations, along with the earnest wish of his family to return to their former home, led him to tender his resignation, and resume his chair in the University of Louisville, his successor, Dr. Paul F. Eve, having withdrawn in his favor.

The winter passed in New York was the most charming he had ever spent. With four didactic lectures and two clinics a week, and little private practice, he gave himself up to amusements, social intercourse, and visits to the hospitals. He also attended a course of lectures on the microscope by Mr. Goadby, an English gentleman, and spent much of his leisure upon the composition of his work on the urinary organs, commenced several years previously, and completed a short time before the close of this winter's lectures. Had he remained in New York, he would doubtless have obtained a very large practice; but as he had left a more lucrative school, and had the most commanding surgical practice in the Southwest, he deemed it most prudent to retrace his steps.

Soon after Dr. Gross first went to Louisville, he instituted a series of experiments upon dogs, with a view of determining, more accurately than hitherto had been done, the nature and treatment of wounds of the intestines. These investigations, which were commenced in the spring of 1841, and continued, with various intermissions, for upwards of two years, involved the sacrifice of seventy dogs, and the results were originally published in a series of papers in the *Western Journal of Medicine and Surgery*, and finally embodied in a separate monograph, forming an octavo volume of two hundred and twenty pages, illustrated by wood-cuts

and colored engravings, and entitled an "Experimental and Critical Inquiry into the Nature and Treatment of Wounds of the Intestines." The work was an exhaustive one, and comprised an account of his own researches, as well as a sketch of the literature of the subject. It was most favorably noticed in a long review in the *British and Foreign Medico-Chirurgical Review*, and was quoted approvingly by Mr. Guthrie in his work on "Military Surgery."

Much labor was spent upon these experiments, and they involved not a little sacrifice of feeling on his part, as he was naturally fond of dogs, and anæsthetics had not yet been discovered. In this connection, in view of the attacks on the profession now being made in this city by the American Antivivisection Society, it will prove interesting to quote the language of Dr. Gross, penned ten years ago, on this subject. He says:—

"I have sacrificed for experimental purposes nearly one hundred dogs, and, if I were not thoroughly satisfied that the objects had been most laudable, I should consider myself as a most cruel, heartless man, deserving of the severest condemnation. The results of my experiments will, I am sure, eventually receive that attention to which their importance so justly entitles them. The experiments of Jones on hemorrhage, of Smith and Travers on wounds of the intestines, of Magendie and Charles Bell on the functions of the nerves, and of hundreds of physicians upon the action of medicines upon the human frame, have shed an immense flood of light upon the healing art, putting to flight the mawkish sentimentality of the societies for the prevention of cruelty to animals, which have made so much ado about this matter."

His work entitled "A Practical Treatise on the Diseases,

Injuries, and Malformations of the Urinary Bladder, the Prostate Gland, and the Urethra" was published by Blanchard & Lea in 1851, the MS. having been deposited with them on his return from New York to Louisville. The only then existing monographs on these affections of any importance in the English language were those of Sir Benjamin Brodie and Mr. William Coulson, two comparatively meagre productions, which, although very valuable, especially the former, were unsatisfactory. Hence such a work had long been needed, and it was at once accepted as an authority upon the subjects of which it treated. He had for some time been accumulating the materials, and not less than three years were finally spent in arranging them for publication. A second edition, greatly enlarged and improved, was issued in 1855, and formed a closely-printed octavo volume of 925 pages, illustrated by 184 wood-cuts. In an appendix of 29 pages is the first and only attempt as yet made to furnish a complete account of the prevalence of stone in the bladder, and of calculous disorders in the United States, Canada, Nova Scotia, Europe, and other countries. In 1876 a third edition of the work appeared under the editorship of Dr. S. W. Gross, who rewrote much of it, introduced considerable new matter, and produced a valuable treatise fully up to the existing state of the science.

Dr. Gross's "Practical Treatise on Foreign Bodies in the Air-Passages" was issued from the press of Blanchard & Lea, in 1854, in an octavo volume of 468 pages, illustrated by 59 engravings on wood. Its composition required upwards of two years, and as it was the first attempt, in any language, to systematize our knowledge upon the subject, it was, strictly speaking, a pioneer work. Dr. Morrell Mackenzie, the highest authority upon the subject in Europe, in speaking

of it, nearly thirty years after its publication, in his own admirable treatise on "The Diseases of the Throat and Nose," makes the following remarks: "This invaluable essay gives full reports of two hundred cases, and is so complete that it is doubtful whether it will ever be improved upon; indeed the excellent articles of Bourdillat and Kühn subsequently published, the former based on three thousand, the latter on three hundred and seventy-four cases, only confirm the conclusions previously arrived at by Gross." It might have been added that Kühn plagiarized much of his material.

During his residence at Louisville, Dr. Gross was a liberal contributor to the *Western Journal of Medicine and Surgery*, edited by Dr. Drake. Among his earliest papers was an account of a case of axillary aneurism, for which he tied the subclavian artery. It was accompanied by a statistical notice of all that had been done in regard to the surgery of this vessel up to that period. Another very elaborate paper was published in 1852 on the "Diseases and Operations on the Jaws," and one of his last contributions to its pages was a "Discourse upon the Life and Character of Daniel Drake," embracing nearly one hundred pages.

In 1851 he prepared a very full and exhaustive "Report on Kentucky Surgery" for the Kentucky State Medical Society, and afterwards published in its Transactions. It contained a biography of Ephraim McDowell, with a full vindication of his claims as the originator of ovariotomy in 1809. In 1853 he sent to the American Medical Association, at its meeting in Richmond, Virginia, an exhaustive report on the "Results of Surgical Operations in Malignant Diseases." It comprised one hundred and thirty-seven pages of its volume of Transactions, and embodied the experience of the principal surgeons of all ages and countries. At the

meeting of the Association at Detroit, in 1856, he read a "Report on the Causes which Retard the Progress of American Medical Literature," in which he took strong ground against the editing of foreign works by American writers, and animadverted in severe terms upon our medical journals for their indiscriminate praise of European reprints. During the same period he contributed several papers to the *American Journal of the Medical Sciences.* One of these was the report of a case, full of interest, of "Gunshot Wound of the Neck, involving the Spinal Cord and Subclavian Artery, and Causing Death by Convulsions." The paper, however, which attracted most attention was the report in the October number for 1852 of an operation which he performed in 1849 upon a child three years old, the subject of a congenital malformation, consisting in complete absence of the vagina and the presence of well-formed testes in the labia. The object was to prevent effectually, if possible, the development with puberty of sexual desire, as the malformation would render intercourse quite impossible. Although the operation was severely criticized, Dr. Gross never felt cause to regret the course he had adopted.

In the winter of 1856, Dr. Gross and Dr. T. G. Richardson founded the *Louisville Medical Review*, a bi-monthly journal of medicine and surgery, of which only six numbers appeared, since, by a strange coincidence, soon after the publication of the first, both editors received and accepted appointments in Philadelphia, Dr. Gross to the chair of Surgery in the Jefferson Medical College, and Dr. Richardson to that of Anatomy in the Pennsylvania College. Soon after their removal to Philadelphia, they issued the *North American Medico-Chirurgical Review*, one of the peculiar features of which periodical was that each department of the sciences

was intrusted to a separate contributor, whose duty it was to furnish an abstract of the current literature, so that it always fully reflected the latest discoveries and improvements. The work prospered until the outbreak of the war, when all the Southern subscribers dropped off, and the publishers, J. B. Lippincott & Co., were compelled to abandon it, at the close of its fifth year of publication. To the pages of these journals Dr. Gross contributed a number of original articles and elaborate reviews, including among others a remarkable and curious case of "Congenital Hypertrophy of the Gums," the "Nature and Treatment of Tuberculosis of the Hip-joint," "August Gottlieb Richter: his Works and his Contemporaries—A Retrospective Sketch," into which he introduced an account of Desault, Benjamin Bell, and Antonio Scarpa, and, finally, "A Sketch of the Life and Services of Ambrose Paré." The journals were also made, during the greater part of their existence, the vehicles of the reports of his clinics at the University at Louisville, the Jefferson Medical College, and the Philadelphia Hospital.

In 1855 Dr. Gross was solicited by Dr. René La Roche, a member of the Board of Trustees of the University of Pennsylvania, to allow his name to be placed before that body, as a candidate for the chair of Surgery, vacated by the resignation of Dr. Gibson. He was assured that the entire medical faculty, with the exception of Dr. George B. Wood, had pledged themselves to support him, and would use their best endeavors to secure his election. Various reasons, however, induced him to decline, and he wrote, at the request of Dr. D. Hayes Agnew, a warm testimonial in favor of Dr. Henry H. Smith, who was elected.

Dr. Gross remained at Louisville for sixteen years, from October, 1840, to September, 1856. He became closely iden-

tified with the people and the interests of that city, and he was regarded as the most prominent surgeon of the Southwest. Hence it is not surprising that when it was announced in May, 1856, that he had accepted the chair of Surgery in the Jefferson Medical College, universal regret was expressed by both the medical profession and the citizens of Louisville. He received numerous letters from medical men in various parts of the valley of the Mississippi, remonstrating with him against his removal, but he did not feel that he could decline the honorable position in his Alma Mater, which had been unanimously tendered him by its Board of Trustees and the faculty. Moreover, a strong motive which impelled him to remove to Philadelphia was the desire to be relieved of a large and annoying family practice, so that he might write an elaborate system of surgery, for which his leisure in Louisville was not sufficient, but upon the composition of which he had been engaged for several years.

Dr. Gross reached Philadelphia on Saturday, September 26, 1856, and delivered his first clinical lecture on the following Wednesday. He brought with him about one-half of his library, which consisted of nearly 4000 volumes, having deposited the remainder in boxes in the University of Louisville for safe-keeping. As he was about to go before his class on the ensuing 24th of December, the following telegram was handed to him: "The University was totally consumed by fire early this morning, including all your books and minerals." This intelligence greatly shocked him, his loss being the more keenly felt, as it comprised the most complete collection of works on the genito-urinary organs ever brought together in this country. Many of the books and pamphlets were from the library of the late John

C. Crosse, the eminent lithotomist of Norwich, England, and could never be replaced.

In order that his literary pursuits might not be too much interfered with, Dr. Gross, upon his arrival in Philadelphia, confined himself strictly to office and consultation practice to patients from abroad, and to surgical operations. He set to work vigorously upon the completion of his "System of Surgery," which he had determined to make the most elaborate, if not the most complete, treatise in the English language. The heads of his lectures served him as a valuable guide, and he generally wrote with great facility, as his knowledge of the subject, from long study, practice, and teaching, was extensive, and, in the main, very accurate. He spent from five to eight hours a day upon his manuscript, and, unless greatly interrupted, he seldom wrote less than from ten to fifteen pages of foolscap in the twenty-four hours, and rarely rewrote anything, although he not unfrequently interlined. In this way he worked steadily until July 8, 1859, when he finally wrote the preface. Soon after, the work was issued in two portly octavo volumes, numbering, in the aggregate, 2360 pages, and profusely illustrated by engravings on wood. The sixth edition was published in October, 1882, and it was so thoroughly changed and so greatly improved over the preceding editions, as to constitute essentially a new production. The review of this work which gratified him most was given of the fifth edition in the *Dublin Journal of Medical Science* for 1874. It covered nearly fifty pages of that periodical, and was at once able, analytical, and critical. The review thus concludes: "His work is cosmopolitan, the surgery of the world being fully represented in it. The work, in fact, is so historically unprejudiced, and so eminently practical, that it is almost a

false compliment to say that we believe it to be destined to occupy a foremost place as a work of reference while a system of surgery, like the present system of surgery, is the practice of surgeons." A Dutch translation, by Dr. Sachse, appeared at Nieuwediep in 1863.

At the outbreak of the war, Dr. Gross wrote a brief "Manual of Military Surgery," a pocket companion for the young surgeons who were flocking into the army. It was composed in nine days, and published in a fortnight from the time of its inception. Under the care of Lippincott & Co., it passed through two editions of 2000 copies each, was republished at Richmond, and was extensively used by the Confederate surgeons, and in 1874 was translated into Japanese and published at Tokio.

In 1861 Dr. Gross edited an octavo volume of upwards of 800 pages, entitled, "Lives of Eminent American Physicians and Surgeons of the Nineteenth Century," his own contributions being sketches of Ephraim McDowell, the ovariotomist; Drake, the great Western physician; and John Syng Dorsey, the nephew of Physick, and the author of the "Elements of Surgery."

In 1868, in the address which he read before the American Medical Association at its meeting at Washington, as its President, he called attention, among other matters, to a new method of appointing medical witnesses as experts in cases involving medico-legal considerations. In 1869, at the meeting at New Orleans, an elaborate paper from his pen on the "Training of Nurses" was read, which attracted much attention. At its meeting at Detroit, in 1874, he read an address on "Syphilis in its Relation to the National Health," which received the highest commendation, Dr. Sims offering a resolution for the appointment of a committee to present

the subject to the consideration of the legislatures of the different States and Territories. The following year he read before the same body, at its meeting at Louisville, "A Discourse on Bloodletting considered as a Therapeutic Agent;" and at its meeting in Chicago, in 1877, he read a paper on the "Proximate Cause of Pain." In October, 1875, he delivered two elaborate lectures introductory to his course at the College on the "History of American Medical Literature from 1776 to the Present Time," which were afterwards issued in a brochure of 85 octavo pages.

In the *American Journal of the Medical Sciences* for April, 1876, is an article, occupying 53 closely printed pages, from his pen on the "History of American Surgery from 1776 to 1876," which is one of several papers prepared by different writers illustrative of the progress of the different branches of medicine in this country during the century, and which, together with those papers, was issued in book form under the title of a "Century of American Medicine."

During his residence in Philadelphia, in addition to the works and papers already mentioned, Dr. Gross made many literary contributions to various journals and societies, among which may be mentioned "Practical Observations on the Nature and Treatment of Prostatorrhœa," 1860; "Brunonianism, Toddism, and other Isms," 1860; "Necrological Notice of Jedediah Cobb, M.D., formerly Professor of Anatomy in the University of Louisville," 1861; "Biographical Sketch of Charles Wilkins Short, M.D., formerly Professor of Materia Medica and Medical Botany in the University of Louisville," 1865; "Then and Now," 1867; "The Live Physician," 1868; "A Memoir of Valentine Mott, M.D.," 1868; "A Memoir of Robley Dunglison, M.D.," 1869;

"Nature's Voice in Disease and Convalescence," 1870; "A Discourse on Ambrose Paré," 1873; "An Oration in Honor of Ephraim McDowell," delivered before the Kentucky State Medical Society at its meeting at Danville, at the dedication of the monument erected to his memory, 1879; "A Memoir of Dr. Isaac Hays," late editor of the *American Journal of the Medical Sciences*, 1879; "John Hunter and his Pupils," 1881; "Value of Early Operations in Morbid Growths," 1883; and "The Best Means of Training Nurses for the Rural Districts," 1883. His last contributions, composed a few weeks before his death, were one on "Wounds of the Intestines," read before the American Surgical Association, by Professor Richardson, April 30, 1884; and one on "Lacerations of the Female Sexual Organs, consequent upon Parturition, their Causes and their Prevention," read before the American Medical Association, on May 8, 1884, two days after he expired.

Dr. Gross became a writer early in his professional life. He had hardly received his degree before he began to translate French and German medical works. During the first summer, he assisted Dr. John D. Godman, the anatomist and naturalist, in translating the Duke of Saxe-Weimar's "Travels in the United States," and the next year he wrote his work on the "Bones and Joints." He was always a hard student and incessant thinker. He accomplished the vast amount of writing which he did simply by working in an orderly and systematic manner, with a distinct, definite aim, and never allowing anything to interfere with the consummation of his labors. As he frequently said, his genius was the genius of industry, perseverance, and common sense. He thought out many of the details of his writings while

making his daily rounds, and it was his constant habit, on returning to his office, to commit to paper what he had outlined in his busy brain.

After his graduation, the great ambition of Dr. Gross was to become a teacher. His first effort in this direction was as Demonstrator of Anatomy in the Medical College of Ohio, in which, as previously stated, he delivered three lectures a week for two years. In the Cincinnati College he lectured for four years on pathological anatomy, after which he taught surgery for forty-two years. During all this time he invariably spoke extemporaneously with the aid of a few brief headings ; but he never appeared before his class without previous study and meditation, and a thorough comprehension of his subject. Order and system were among his more important attributes as a teacher. Those who have heard him will never forget his enthusiasm ; the clearness, force, and directness of his language ; the marked interest he felt in what he was saying and doing ; and the evidence of the feeling that he had a solemn duty to perform, and that upon what he uttered might depend the future happiness or misery of thousands of human beings. The opening portion of his course on surgery was devoted to the discussion of the principles, the topics discussed having been inflammation and its consequences, syphilis, struma, tumors, and wounds. These topics being disposed of, he took up the diseases and injuries of particular regions, organs, and tissues, confining himself as much as possible to matters of fact, and not indulging in hypotheses, conjecture, or speculation. His knowledge of pathological anatomy was of immense benefit to him in these exercises, and he freely availed himself of it as a means of illustrating every subject that he had occasion to discuss. Indeed, he always asserted, that whatever repu-

tation he possessed as a teacher and a writer, was in great degree due to his familiarity with morbid anatomy. What added greatly to his charm as a lecturer were his admirable diction, his commanding presence, and a resonant and well-modulated voice.

In March, 1882, being in the full possession of his intellectual and physical powers, but being actuated by a desire to spend the remainder of his days in comparative repose, he resigned the chair of Surgery in the Jefferson Medical College, which he had filled for twenty-six years, and he was thereupon unanimously elected emeritus professor.

Dr. Gross had a great fondness for surgery. After his removal to Louisville, his name became widely known as a practical surgeon, and after the retirement of Dr. Dudley, who had so long wielded the surgical sceptre at Lexington, there was no one in the Valley of the Mississippi who did So large a practice as he. He possessed all the qualities of a good operator, a thorough knowledge of regional anatomy, quick perception, rapidity in judgment, perfect self-control, a steady hand, and an unflinching eye. He rarely failed to accomplish what he had set out to do, and he never lost a patient upon the table from shock or hemorrhage. He performed many major operations, and had an extended reputation as a lithotomist, having cut 165 patients, with 14 deaths. Of 72 children, all except 2 survived, while of 93 operations in adults and old persons, 12 died.

During the War of the Rebellion, he took great interest in gunshot wounds, visiting many battle-fields and hospitals to observe their peculiar features, of which he made valuable notes. In the spring of 1862, Surgeon-General Hammond offered him the post of Surgeon-in-Charge of the George St.

Hospital in this city, but as in his own opinion he had no fitness for the position he promptly declined it, preferring to be placed in charge of the surgical ward, so as to be the better able to study gunshot injuries.

In addition to the various experiments already alluded to, he made not a few original contributions to surgery. He was the first to suggest or perform for ganglia of the hand and foot subcutaneous section followed by firm compression; high amputation in senile gangrene; the suturing of divided nerves and tendons; deep stitches in wounds of the wall of the abdomen, to prevent hernia or protrusion of the bowel after recovery; wiring the ends of the bones in dislocations of the sterno-clavicular and acromio-clavicular articulations; a modification of Pirogoff's amputation at the ankle joint, unjustly ascribed to Dr. Quimby; a mode of operating for inverted toe nails; an operation for neuralgia of the jaws in old persons; laparotomy in rupture of the bladder; and a direct operation for hernia by suturing the pillars of the ring. He was also the first to describe prostatorrhœa, pododynia, and the use of adhesive plaster as a means of making extension in the treatment of fractures of the lower extremity. He was the inventor of an enterotome, urethrotome, tracheotomy forceps, blood catheter, arterial compressor, tourniquet, an instrument for extracting foreign bodies from the ear and nose, and an apparatus for the transfusion of blood. In his "Pathological Anatomy" he has given a description of a number of dissections of specimens of false conception or uterine moles, as they are termed, the first account in the English language. He was also the first to suggest the use of ergot in the treatment of diabetes.

Dr. Gross's majestic form and dignified presence, his broad brow and intelligent eye, his deep, mellow voice, and benig-

nant smile, his genial manner and cordial greeting, remain indelibly impressed upon the memory of all who knew him. He was a man of deep mind and broad views, and he was a model of industry and untiring zeal. He always had some literary work in hand, and he was in the habit of rising early in the morning, generally at six o'clock, and accomplishing considerable writing before breakfast. His style was vigorous and pure, and the amount of work he accomplished was simply immense. It is safe to say that no previous medical teacher or author on this continent exercised such a widespread and commanding influence as did Prof. Gross. His writings have been most learned and voluminous, and his classes among the largest that have ever been collected in this country. As a citizen he was public-spirited and influential, and he always most jealously guarded the *esprit de corps* of his own profession. In every project to advance its interests or to protect or honor any of its deserving members he was foremost. On account of the universally recognized eminence of his authority as a surgeon he was frequently called into court as an expert to testify in malpractice suits, and he was ever ready cheerfully to give his time, knowledge, and influence in maintaining the right, and he never thought any trouble too great to aid a professional brother. He took a deep interest, too, in the struggles and success of young men, born perhaps of his own experience, and he was always ready to assist them by his counsel and advice. His house was the seat of a wide and generous hospitality, and distinguished strangers, professional and non-professional, were welcome guests at his table. While fond of social life, he never appeared so happy as when surrounded by his own family. He was, too, an ardent lover of the beauties of nature, with a special fondness for flowers, of

which a few were always to be found at his side on his study table.

Dr. Gross attained unusual eminence in the world of medicine. He was a member or fellow of numerous medical societies and other organizations, both American and foreign, including among the former, the College of Physicians of Philadelphia, the Philadelphia County Medical Society, the Pathological Society of Philadelphia, the Philadelphia Academy of Surgery, the Academy of Natural Sciences, the American Philosophical Society, the Medical Society of the State of Pennsylvania, the Medical Jurisprudence Society of Philadelphia, the Massachusetts Medical Society, the Rhode Island Medical Society, the New York State Medical Society, the Academy of Medicine of New York, the Cincinnati Medical Society, the Ohio Historical and Philosophical Society, the Medical Society of Louisiana, the Kentucky State Medical Society, the American Medical Association, the American Surgical Association, the National Association for the Protection of the Insane, and the American Public Health Association. He was the founder of the Pathological Society of Philadelphia, of the Academy of Surgery of Philadelphia, and of the American Surgical Association, and one of the founders of the Kentucky State Medical Society, and of the Medical Jurisprudence Society of Philadelphia, of which organizations, as well as of the International Medical Congress, held at Philadelphia in 1876, the Philadelphia County Medical Society, the Medical Society of the State of Pennsylvania, the American Medical Association, the Medical College Association, and the Pennsylvania College of Dental Surgery he served as president. Of foreign societies, he was an honorary member of the British Medical Association, the Royal Medical and Chi-

rurgical Society of London, the Clinical Society of London, the Pathological Society of London, the Medico-Chirurgical Society of Edinburgh, the Imperial Medical Society of Vienna, the Medical Society of Christiania, the Royal Society of Public Medicine of Belgium, and the Medical Society of San Luis Potosi.

On April 3d, 1881, Dr. Gross received a letter from Mr., now Sir William MacCormac, Honorary Secretary-General, inviting him to deliver the address in behalf of the American delegates to the International Medical Congress, which met in London, in August of that year. To his great regret, he was unable to be present, and therefore was forced to decline the honor.

Dr. Gross was made an LL.D. by the Jefferson College, of Canonsburgh, in 1861. In 1872, the University of Oxford conferred upon him the degree of D.C.L.; the University of Cambridge her degree of LL.D. in 1880; and the University of Edinburgh and the University of Pennsylvania conferred the same degree, *in absentia*, in April and May, 1884.

Save an occasional twinge from rheumatic gout during his later years, Dr. Gross enjoyed excellent health to within a few months of his last illness. During the autumn and early winter of 1883, he was troubled with several attacks of indigestion, swollen feet, and other signs of weak heart, which, however, readily yielded to remedies. Early in January, he had a mild attack of bronchial catarrh, which confined him to the house. Being thus deprived of out-door exercise, signs of dyspepsia again set in, and with the view of gaining strength to attend the meetings of the American Surgical Association, and of the American Medical Association in May, upon which he had set his heart, he went to Atlantic City on the 31st of March. On the following April

6th, he was seized with intense nausea, and reached home the next afternoon much exhausted. From this time until his decease, May 6th, at twenty minutes to one o'clock, it was with great difficulty that he could be induced to take nourishment, and death ensued from sheer exhaustion, despite the unremitting attention of Professor Da Costa, and of his son, Professor S. W. Gross, aided by the wise counsel of his able and distinguished friend, Professor Austin Flint.

The post-mortem examination disclosed marked gastric catarrh, with irregular thickening of the mucous membrane, fatty heart, and a large cyst of the right kidney. The brain weighed forty-eight ounces.

The funeral services were held in the presence of his family and attendants, on the afternoon of May 7. His remains were then taken to the crematory at Washington, Pa., where they were reduced to ashes. On the following Sunday they were deposited in the family vault at Woodlands Cemetery. These last rites were strictly in accordance with his expressed wishes; and his friends had known for many years his desire to be cremated, which he regarded as the only decent and correct manner of disposing of the dead.

The record of such a well-spent life is a valuable lesson which we do well to study and reflect upon. It serves as both precept and example, and invites us to emulate that energy, assiduity, and perseverance through which, aided by considerable native ability, the subject of this memoir acquired widespread distinction as a surgeon, a writer, a teacher, and a man. It shows that talent with industry cannot be repressed by adverse surroundings, but that it grows stronger in overcoming obstacles. Had Dr. Gross after graduation supinely waited for his ability to be discovered and for preferment to seek him, sheer want would probably have driven

him to other pursuits, and his name would have been unknown to surgery. But, as we have seen, from the very moment of his graduation he entered upon the restless contest for distinction, and he created his own opportunities for advancement. When as yet he had had no time to gain experience in the practice of his profession, he did useful work, and made his name known by translating the books of several Continental authors of distinction. Shortly afterward, under all the disadvantages of restricted means and adverse surroundings, he undertook original investigations in anatomy, physiology, pathology, and surgery, which gradually gave him a substantial and constantly-growing reputation, until finally he reaped, through the force of his own labors, all the honors which his own profession could bestow, and enjoyed a celebrity extending over both continents.

In the death of Dr. Gross we have lost one of the brightest examples of the skill and learning, the conscientiousness and assiduity, the patience and perseverance, the dignity and morality by which our profession is truly ennobled. He has left us as a heritage a world-wide reputation which, as we regard it with conscious pride, cannot but stimulate us to a higher sense of our duty to our profession and to our fellows.

ADDRESS

DELIVERED AT THE CLOSE OF HIS TERM OF OFFICE,

By

ALFRED STILLÉ, M.D., LL.D.,
PRESIDENT OF THE COLLEGE.

[Delivered January 2, 1884.]

Fellows of the College:—

It has recently been made the duty of the President to deliver an address at the close of his annual term of service. It is singular that a custom which is so general in European medical societies should not have been earlier adopted here. That it should have been so at all, however tardily, is, perhaps, one of the signs which the College has recently given of awakened life and energy. It is both natural and proper that the presiding officer, on laying down his dignity, should review the work accomplished during the previous year, and make whatever suggestions, drawn from the history of the recent or of the remoter past, may seem fitted to keep alive the interest of the Fellows, and incite them to new endeavors to promote the prosperity of the institution. To do so in the present instance would demand more time than is at my disposal, and perhaps a heavier tax upon your patience than I am willing to impose. But I will ask your attention to a brief summary of the proceedings of the past year, followed by some considerations drawn from the history of the College. A more elaborate account of its rise and progress could not fail to be interesting, and I am not without hope that it may yet be attempted by a competent hand.

During the year 1883 the College has manifested an unwonted degree of activity. The most conspicuous record thereof is the

volume of its Transactions published last July. It contains nearly four times as many pages as the previous volume issued in July, 1881, and which represents an equal period of time. Moreover, the papers thus printed in the first half of 1883 occupy a space as great as all of those presented during the previous eighteen months. Among other evidences of an awakened interest among the Fellows may be mentioned their increased attendance at the meetings, and the number and value of the communications made in the latter half of the year, and which are still unpublished by the College.

It is unnecessary for me to attempt an analysis of the various papers that were presented, but it is my duty to remind you of the amount and the nature of the work performed, and thereby perhaps to tempt some who now neglect your meetings to encourage you by their presence, and profit by the instruction offered them.

In General Pathology few who heard it will forget the investigation of the poison of *Heloderma suspectum*, by Drs. Mitchell and Reichert (Feb. 7), and the striking contrast between the action of this poison upon the heart and spinal cord, and that of serpents' venom which arrests the respiration and disorganizes the blood.

A clinical study and demonstration of the cranial nerves by Dr. Allen (June 6) furnished some material helps to the diagnosis of affections involving those organs. The author especially dwelt upon the means of estimating the diffusion of central lesions by the extension of the distal symptoms.

The only communication relating to morbid anatomy was a verbal one made by Dr. Dulles (Oct. 3) respecting a case of fatal uterine hemorrhage caused by intra-mural and internal tumors of the uterus, regarding which a question arose whether operative interference might have prevented the fatal result.

The question of causation of typhoid fever by sewer gas was discussed in a very agreeable manner by Dr. Hamilton (Mar. 7), and the doctrine, generally accepted in Europe and in this country, of its origin in fecal fermentation and other putrefaction was actively combated.

In Practical Medicine Dr. J. C. Wilson (Jan. 3) communicated the results of his treatment of typhoid fever by means of massive doses of calomel, tincture of iodine, and carbolic acid, to which in cases of hyperpyrexia sedative doses of sulphate of quinine

were added. Each of these medicines has been used for the same purpose by others, but perhaps they have not before been systematically associated. It is, in view of these and other therapeutic suggestions, of supreme interest to know that the lowest mortality-rate in this disease has always been secured without active medication.

A paper on Enteric Paraplegia was read (Nov. 7) by Dr. Bartholow, in which he sought to differentiate cases of paraplegia of reflex origin from others which are generally regarded as effects of ascending neuritis. The subject is difficult from its complexity and obscurity, and very often the true nature of the disease is revealed only by the effects of treatment.

The familiar fact that rheumatic and neuralgic persons are liable to exacerbations of suffering, especially in certain kinds of weather, was elaborately illustrated (June 6) by the observations of Capt. Catlin, U. S. Army, in his own case, and by the commentaries of his physician, Dr. Mitchell. So minute and detailed a personal history of disease is rarely possible, for few men possess at once the intelligence to observe and the patience to study the infinite phases of a painful malady affecting themselves.

The first of the surgical papers of the year (Jan. 3), which was presented by Dr. Roberts, and entitled "Heart puncture and heart suture as therapeutic procedures," demonstrated that surgeons had attempted operations of questionable propriety, as physicians had been known to experiment with poisons upon human life. Such methods, I venture to think, cannot be approved by wise and prudent practitioners.

The cause of humane and conservative surgery was illustrated by the paper of Dr. Solis-Cohen (April 4) entitled "Does excision of the larynx tend to the prolongation of life?" The author's discussion was limited to cases of carcinoma of the larynx, and he arrived at the conclusion that in them this operation does not tend to prolong life, and is inferior, as a palliative measure, to the performance of tracheotomy.

Dr. Walter F. Atlee related (March 7) the case of a woman from whom he removed a large abdominal cystic tumor by laparotomy, and on whom, when the tumor recurred seven years later, he performed the operation of tapping through the vagina with a fatal result. The conclusion of the paper, that polycystic tumors

of the abdomen should be removed by abdominal incision, and that if their evacuation through the vagina is performed, it should be attended with all the precautions of antiseptic surgery, appeared to be approved by all of the Fellows who discussed the subject.

Dr. Packard (Dec. 5) read the notes of a case of abdominal tumor appearing soon after marriage and simulating pregnancy, and terminating fatally after laparotomy, which revealed nothing definite as to the nature of the tumor.

At the meeting of April 5, Dr. Hopkins read the report of a "Case of resection of the radius, performed by Dr. John Rhea Barton, in 1828," and presented the patient who had been the subject of it. It rarely happens that an opportunity occurs of studying the result of an operation of the sort after so great a length of time. In this case the patient's arm had acquired a remarkable degree of power and ease of motion.

The only paper relating to the action of medicinal substances related to arsenical paralysis, and was presented by Dr. Mills (Feb. 7). It contained a minute study of the atrophic, paralytic, and neuralgic phenomena of arsenical poisoning, and attributed them to central lesions rather than to alterations of the nerves.

The College was favored (May 2) with a very elaborate discussion of "Infant foods," by Prof. Leeds, of the Stevens Institute of Technology, in which it was argued that cow's milk is no substitute for human milk in the dietary of infants, and that to render it digestible it must be "*attenuated*" by some one or more of the substances which have long been employed empirically for the purpose, or by some one or another of the preparations manufactured for this use.

In the same connection a timely communication was made by Dr. J. M. Keating (June 6) which demonstrated that some children are capable of insalivating and digesting starchy food at a much earlier age than has hitherto been supposed. This experimental paper confirms what all physicians of experience must have observed, that among the poor many infants thrive upon a diet which is shocking to scientific propriety.

The same proposition was also maintained and still further illustrated by the careful examination of the feces of starch-fed infants which was made by Dr. Randolph (June 6). The one

observer had proved that infants can, and the other that infants actually do, digest starch.

In his annual report on Meteorology and Epidemics, Dr. J. G. Richardson discussed at some length the question of preventing by law the dissemination of smallpox (Dec. 5). The reasons which were assigned in favor of such a measure must be approved by every candid and benevolent person. But, when it is remembered how senseless and extravagant an opposition was made in this country as well as in Europe to sanitary measures for limiting syphilis, a disease more terrible than smallpox, because its virulence infects even unborn generations, it must seem utopian to expect such rational and wholesome legislation as that proposed in the Report.

The College listened with interest to the memorials of Dr. Fox and Dr. Stewardson, prepared by Dr. Ruschenberger with great fulness and precision of details. Those physicians were, at the time of their death, the senior Fellows of the College, and, as they had long since retired from active practice, few were aware of the prominent positions they once held, the one in surgery and the other in medicine. It may be hoped that their character and attainments as described by their biographer, himself within a year of being a contemporary of the elder of them, may incite those who have still a medical career before them, to take pattern by such examples of professional industry and probity.

In January the death of Dr. John Forsyth Meigs was announced, and his son, Dr. Arthur V. Meigs, was requested to prepare a memoir of his distinguished father, as the latter had himself read before the College a biography of his own father, the late eminent and celebrated Charles D. Meigs.

The College has lost by death, during the year, of its Fellows, Doctors Henry L. Silliman, William Lehman Wells, Robert Burns, and William D. Stroud. The death of the following Associate Fellows was also announced: Archibald Hall, of Canada; Hermann Walther, of Dresden, Saxony; John T. Hodgden, of St. Louis, Mo.; Thomas B. Peacock, London, Eng.; and P. T. Da Costa Alvarenga, Lisbon, Portugal.

One resignation of Fellowship occurred during the year; three Fellows elect did not accept Fellowship; and seven Fellows forfeited their connection with the College by non-payment of their

dues. On the other hand, sixteen Fellows were added during the year, a number which has only once been exceeded (1864) in the history of the College, and has but twice been equalled (in 1839 and 1870). The College has added to the roll of its associates Christopher Heath, Esq., F.R.C.S., and Sir Joseph Fayrer, M.D., K.C.S.I.

One of the most notable incidents of the past year was the donation of five thousand dollars to the College by Dr. Mitchell (Feb. 7), the interest of which is destined to pay the expenses of one or more annual *conversaziones* at which the College will entertain persons not connected with it except by the common bond of scientific and literary accomplishments and their interest in the welfare of the institution. This new feature, which is borrowed from one that is usual abroad, cannot fail to draw more closely together, and animate with a common enthusiasm, all who desire to see the leaven of modern civilization, which tends constantly to a greater union of feeling and labor, permeating every portion of society.

At the stated meeting in February the Council recommended that a committee be appointed to solicit contributions to a fund which is destined to place upon the College Hall the additional story contemplated in the original plan of the building. This committee, having been duly formed, entered upon its work, and has already collected a sum which will serve as a nucleus for the large amount that will be necessary for making the addition to the building, which is imperatively necessary for accommodating the constantly increasing collection in the College Museum, and which, it will be remembered, is due to the munificent bequest of the late Dr. Mütter. It may here be pertinent to suggest, as matter for the consideration of the Committee on the Museum and of the College itself, whether measures may not be adopted for increasing the usefulness of this very valuable collection.

Such, Fellows of the College, is a brief history of your progress during the past year, and I think it furnishes ample ground for satisfaction, and for faith in the future development of your institution. It also naturally suggests an inquiry into the history of the College to discover there, if possible, the sources of its weakness and of its strength.

Philadelphia has always been distinguished for its conservatism. It has even been charged with going beyond the rule, "try all

things and hold fast to that which is good," with clinging to the old because it is old, in spite of its barrenness of fruit or its actual decay and its incongruity with the existing state of the world. But there was a time when this city was more or less quickened by a different spirit. In colonial days it was the chief seat in America of literary and scientific culture, taste in art, and refinement of manners. The recognized leaders in the professions and in society were either educated Europeans or native Americans who had received a foreign training and who brought home with them the amenities and tastes of cultivated society. Democratic manners and principles were still unknown, for they were the outcome of the revolutionary chaos of France. In the conduct of our provincial affairs the persons of influence were rich in houses and lands, and richer still in the culture of the day and the graces of social life. It was a time when proprietors of large estates inhabited elegant mansions furnished with taste as well as luxury, and surrounded by gardens and extensive woodlands whence they rode forth in State coaches with liveried outriders and footmen. It was a time when, whether wrongly or rightly, the social affairs of this city were directed by an untitled aristocracy, the landed gentry of the colony, although the followers of William Penn far exceeded them in numbers and often in material wealth. It was at this period that tastes were acquired and customs established that many years of adverse influences did not altogether extirpate from the community. Yet those influences were incessantly active, and at length prevailed. The hostility of the greater number of the wealthy and educated to the Revolution that secured the independence of the United States led, sooner or later, to their withdrawal from the country. The manorial possessions of some who remained were for a long time monuments of their wealth and taste, and, indeed, a few still survive to remind the present generation how things, as well as ideas, have been dwarfed, and how far a refined taste for art may give place to a costly display of work that is often as crude and uncouth as it is vulgar.

A few years ago only two monuments of architectural beauty survived, the Pennsylvania Bank and the original United States Bank, now known as the Girard Bank. The former of these was by far the most perfect specimen of Greek architecture that the country possessed; but it has disappeared, apparently without any

protest from Philadelphia, under the action of a government which seemed as unable as Vandals would have been to appreciate the taste in art of our ancestors. Learning fared no better than manners and art when the Corinthian capitals were removed from our social edifice. Before the Revolution, and for some time after it, a liberal education was held to be an essential qualification for professional men. The physician was required to be a scholar, at least to the extent of defending a thesis in the then universal language of medicine, a regulation which of itself insured that only men of a certain degree of culture would seek to enter a profession so jealously conservative of its historical dignity. Little by little not only this formal safeguard was removed, but the preparation for practice was curtailed and made so easy that the profession at last became filled with men destitute of either a base to support or a capital to adorn the great medical edifice they were supposed to sustain. There can, I think, be no doubt that from the commencement of our national independence down to quite a recent period a gradual but steady deterioration took place in the quality of our medical men, until at last it reached the point at which the consciousness of degradation is lost, and when even professors of medicine were found to maintain that not only the common sense, but also the knowledge, discrimination, and skill of American physicians were unrivalled in the world.

It was during this eclipse of knowledge and judgment that our College of Physicians, in common with other medical institutions, sank to its lowest level, and ceased to be either a fountain of knowledge or a court of judgment in medicine. That it has now awaked from its long trance, and that, in common with many other American institutions of learning, it is striving to atone for its sloth and its wasted opportunities, are among the hopeful indications of a nobler intellectual life in the future of our country.

The College of Physicians is not identical in plan or purpose with the other medical bodies of this city. In broad terms, its object is neither to cultivate particular branches of medicine, nor merely to promote brotherhood and union among physicians by subjecting them to the same ethical laws. For the former purposes societies exist which are devoted to special departments of medicine; for the latter as many as possible of the physicians of the city are associated, forming a representative, although not a dele-

gated, body, which by its very numbers claims a right to legislate for the whole profession, and, by its affiliation with the American Medical Association, is clothed with additional powers and dignity. Its primary purpose is professional unity; its promotion of medical science and art, however actively carried out, is, nevertheless, a subordinate object of its existence. The College of Physicians was established upon a broader foundation than either of these, and with higher and more extended aims. Its Charter, granted by the General Assembly of Pennsylvania in 1779, sets forth as the immediate motive for its incorporation, a "conviction of the many advantages which have arisen from literary institutions;" and as its objects, "to advance the science of medicine, and thereby to lessen human misery by investigating the diseases and remedies which are peculiar to this country; by observing the effect of different seasons, climates, and situations upon the human body; by recording the changes which are produced in disease by the progress of agriculture, arts, population, and manners; by searching for medicines in the American woods, waters, and in the bowels of the earth; by enlarging the avenues to knowledge from the discoveries and publications of foreign countries; and by cultivating order and uniformity in the practice of physic."

These large and elevated views will surprise no one who considers the names of the physicians which appear in its charter as the original corporators of the College, and knows that all of them were in a greater or less degree associated in creating or fostering the infant science and art of medicine in the United States. They numbered twenty-seven in all, and there was hardly one among them who was not honorably conspicuous as a teacher, author, or practitioner. Several of them, also, had descendants who maintained their names upon the roll of the College, and by their own character and attainments added lustre to their inheritance. The very names of the founders testify to the fact that it was composed of the *élite* of the medical profession in this city. In the subsequent selection of Fellows the same principle has been substantially maintained to the present day. Hence it may be declared that the action of the College has usually been marked by a degree of deliberation which secured respect for it ultimately, even if it has sometimes been judged by impatient spirits to be unduly conservative or even sluggish in its movements. Nor,

indeed, has this judgment always lacked justification. There have been periods in the history of the College during which no trace of its operations can be discovered in the medical literature of the day; and there have been other periods when its life seemed going out, so feebly and irregularly was it exhibited by published proceedings. And yet, if the list of the Fellows is examined at any period, it will be found to contain the names of nearly all the physicians of Philadelphia who possessed unusual merit. Indeed, so few are the exceptions to this statement that very peculiar reasons must be sought for to explain them.

The original Fellows of the College, in 1787, were twenty-nine in number, and in 1797 they had increased only to forty-two. In the second decennial period but five names were added to the roll, and in the third only ten more. Between 1818 and 1828 it was augmented by fourteen Fellows. But the record of that decade includes the names of Joseph Hartshorne, Bond, Huston, Bell, Hugh L. Hodge, Charles D. Meigs, George B. Wood, La Roche, Benjamin H. Coates, and John K. Mitchell, nearly all of whom entered the College in 1827. This occurrence illustrates the mysterious law by which certain years or cycles are as prolific in distinguished men as others are barren of them. These physicians seem to have brought more vitality into the College: for in the next decennial period the number of new admissions was doubled (28); in that ending with 1847 it reached 64; at the end of 1857 the accessions had been 72; at the end of 1867 the increase was 83; and at the close of 1877 it was 82. At the present time the College has 183 resident Fellows, of whom about four-fifths were elected during the last twenty years, and more than one-third during the last ten years. They consist mainly of young men, who, by the very fact of their election, must be presumed to have given some proof of their attainments and their character, and with whose future distinction the reputation of the College, its influence and its work, will be indissolubly associated. To the young, enlightened, and ambitious physician it ought to be no trifling motive to earnest striving and an upright life, that he belongs to a College that was founded by men of such character and professional rank as Redman, Shippen, Rush, Kuhn, and their associates.

At the foundation of the College, in February 1787, Rush delivered an address in which he set forth its objects and advan-

tages, and marked out its proper career with the sagacity that distinguished him. "Men," he said, "are generally anxious to preserve the good opinion of those with whom they are obliged to associate. The reception we shall meet with from each other in our meetings will serve to correct or improve our conduct. And if we are as chaste as we should be in the admission of members, a fellowship in our College will become in time, not only a sign of ability but an introduction to business and reputation in physic." I need hardly say that these provisions of our most distinguished founder have in the main been fulfilled. One of the very first of the special objects suggested by him was neither immediately, nor at all, carried out by the College. It was the production of an American Dispensatory in which should be realized his cherished desire that the qualities of American medicinal agents should be thoroughly investigated. Nevertheless, the idea of Rush was fulfilled when this College assumed and for a long time maintained the lead in the compilation of the United States Pharmacopœia. He urged the intervention of the College in procuring the enactment of laws to lessen the consumption of distilled spirituous liquors, urging as a motive thereto that such a law had been advocated before the British House of Commons by the College of Physicians of London in 1725. He recommended the pursuit of hygienic inquiries in regard to the modes of life of our people, the effects on the health of agricultural and other pursuits, and he did not neglect the consideration of a question which, upon different grounds, has now risen to importance in political economy, the cutting down of our forests. Rush regarded it as it affected the climate and the public health; and among his observations which have a present application is this, that "in Connecticut, one of the oldest and best cultivated States in the Union, remitting and intermitting fevers are seldom known." We know that since his time there has been more than one recurrence there of malarial fevers. This sagacious observer and thinker foresaw an evil which our own generation has witnessed in its fuller development, the tendency of political excitement to occasion diseases of the nervous system. At the same time, and when as yet emigration to this country was in its infancy, or rather in an embryo condition, he foretold that our nation would become great by its admixture of various European races. "To the

effects of such a mixture," he says, "may be ascribed that elevation and perfection which the human understanding has acquired in Great Britain, and I anticipate the same national character from the operation of similar causes upon the citizens of America." The English historian, Mr. Freeman, who lately visited this country, had the very same idea in his mind when he spoke of this country as "The Greater Britain."

Observations on the summer cholera as a peculiar American disease; on the early decay of the teeth as an American defect of constitution; and on the habit of drinking iced water as a vicious American custom, are now among the commonplaces of popular knowledge; but they were all pointed out by Rush, and the last was the subject of a special essay by him. He drew attention, also, to the danger of using the water of wells near dwellings, and he suggested the use of what he called "fossil coal," *i. e.*, anthracite, as a fuel. In the same discourse he made some acute observations on the possible relations between malarial and dysenteric affections, and advocated the prosecution of what are now called meteorological researches, by the College, and the foundation within the College of a Medical library. This address was delivered in 1787, and in the volume that contains it, and which was published in 1793, a foot-note states that the library "has been established by the College and now consists of a number of scarce and valuable books." Who that knows that your library now contains upwards of 26,000 volumes can doubt that in this, as in all else, the wisdom and prescience of our greatest founder were exhibited?

The Library consisted originally of two or three hundred volumes. For generations it received hardly any additions, and was preserved rather as a museum of fossils than as representing the life and progress of medicine. Its very presence in the hall of the College was felt by some of the Fellows as a constant reproach which at last was heeded by men of a later generation who gathered around this nucleus continual accretions of increasing value until it has now become the most conspicuous and distinctive feature of our institution. It diffuses its influence far beyond the lines that limit our fellowship; it satisfies as well as stimulates a thirst for knowledge; it supplies the steps upon which the present generation is rising and future generations will rise above the more sor-

did level of the past, cultivating in our profession a nobler and purer spirit, and supplying a larger provision of the knowledge which is essential to high attainment. The revival of an interest in the library and the beginning of its expansion date from the period I have already referred to as the epoch of the rejuvenation of the College, or about twenty-five years ago. Thenceforth its annual growth and the cost of maintaining it became so great as almost to shame its struggling infancy; but to work for it was felt to be a labor of love, and to contribute to its extension a duty and also a pleasure that inspired a generous rivalry among the Fellows who became most interested in it. Many of them have ceased from their labors, but their names are inscribed upon our golden roll of honor as a tribute to their memory and an incitement to imitate their liberality. In those who survive, the enthusiasm of generosity has lost none of its ardor, and the one among them whom the College has especially delighted to honor, continues to build a memorial to his name.[1] In after-days, when strangers shall inquire what was done to perpetuate the record of his services, he may be answered in the famous words inscribed upon the tomb of the architect of St. Paul's, "*Si monumentum quæris, circumspice!*"

The first, and for many years the only volume published of the Transactions of the College, contained 254 pages, 8vo. In form it resembled the Transactions of the College of Physicians of London. It was composed of papers that were read between 1787 and 1793. If less elaborate than our modern essays, they have the merit of directness and clearness. Some of them possess a permanent interest, as those of Rush, of which one relates to tetanus caused by the extraction of teeth, and cured by wine and mercury; another to cold water affusions on the loins in the treatment of renal calculus; and a third to the uses of tulip-poplar bark. Senter reports a case of "ischuria," in which the urine was voided by vomiting, and which terminated fatally after several years. The reporter does not seem to have suspected the possibility of such a fraud as hysterical cases have now rendered familiar, and he enters into an elaborate and ingenious disquisition upon the possible channel by which the urine might have been conveyed from its proper receptacles to the stomach. Currie

[1] Dr. Samuel Lewis.

furnishes a succinct but very interesting account of the influenza of 1789; Jacob Hall describes the efficacy of electricity in removing an obstruction from the bile-ducts; Bartram draws a lively picture of stramonium delirium, and describes the effects of cold affusions in constipation, while to the latter remedy the cure of a case of traumatic tetanus is ascribed by Tallman. Bensell presents a graphic narrative of a case of canine hydrophobia in a child seven years old. The child did *not* "recover from the bite," although "the dog it was that died" two days after inflicting the fatal wounds. In this case the period of incubation of the disease was nineteen days, and the symptoms were very characteristic.

With this volume the literary activity of the College, as far as published records show it, appears to have abruptly ceased. Possibly, the written communications may have remained in manuscript; possibly the Fellows may have diverted their energy into other channels; but certainly the College seems for many years to have suffered an obscuration, and shared in the decadence which appears to have overtaken the intellectual productiveness of the country long after its political independence had been achieved. Half a century, within two years, was destined to elapse before it regained its manhood, and ventured to submit its proceedings to public criticism.

In June, 1841, the College resolved to publish a bulletin of its Transactions, and in the following November a committee was appointed to carry this purpose into effect. They expressed a hope that "the result of adopting this course will be to revive that spirit which actuated the College in its earliest years—to encourage the number and value of the communications of its Fellows—to prompt a more punctual attendance, and to insure to the institution, by more fully deserving it, that prominent place in the public respect and confidence to which it has been entitled." They concluded by saying, "Considering what similar institutions are doing in some parts of Europe, both honor and duty would seem to demand that this body should mingle more earnestly in the honorable competition to add to the usefulness and lustre of the profession."

Between 1841 and 1874 the Transactions of the College were published first in the American Journal of the Medical Sciences, and afterwards issued in a separate form entitled a "Quarterly Summary of the Transactions." From 1875 to the present time they

have been published by the College itself at irregular intervals depending upon the amount of material at the disposal of the Committee of Publication. Of this series of the Transactions six volumes have appeared. Whoever has examined the products of this period of forty years and more will, it is believed, be struck by the large proportion of original work in them, and especially since the close of the civil war, when for the first time the dignity of the nation was fully recognized both at home and abroad. It must be admitted that since this momentous crisis the national life has become more intense and masculine, and in every department of intellectual culture, not less than in material prosperity, the people of the United States have asserted for themselves an energy and independence which in their previous history were unknown. This development has been conspicuous in every department of science, literature, and art, and in medicine not less than elsewhere. Medical societies as well as individuals have had their share in illustrating the new life of the nation, and our College has not been behindhand in the progressive movement. Not only has its published work become more original and vigorous, but its very structure has been so far modified as to give freer play to the talent of the Fellows, and greater encouragement for its exhibition than in the past. For such a career, so fairly begun, we may not only hope for, but venture to predict, a brilliant future.

Let me conclude with some further reflections suggested by the position which the College holds in the medical commonwealth. The ideal unity of the profession should never be lost sight of. The various organizations, each of which works for its own ends, should keep in mind that there is a higher object than individual interests, or than those of any particular group of physicians; the character, namely, and the dignity, the progress, and the unity of the whole profession. This duty the present generation has inherited through a long line of illustrious men stretching through all the nations of Europe to its sources in Egypt, Greece, and Arabia, and it should be felt as a noble task, a sacred duty, to transmit it unimpaired to future times. At all periods of medical as of political history there has been a conflict between the selfishness that made the opinions and interests of individuals a permanent rule of conduct, and that nobler and more generous spirit which, even while striving for personal objects, never lost sight of the high ethical principles that belong to no one genera-

tion, but are the same "yesterday, to-day, and forever." Just so far as men or associations cling to those fixed moral laws, and refuse to be warped by fleeting opinions and merely personal interests, will their dignity be enhanced and their influence upon society be deep and lasting.

The history of this College justifies the belief that it will not readily fall from the high level it has occupied as a conservator of sound science and pure ethics. But there is nothing in this position inconsistent with its taking a more lively and effective part in the discussion of questions of contemporary interest; not, indeed, that it should play the part of a gladiator, and contend for the sake of the conflict merely, but the part rather of a mediator, or of a judicial tribunal in which the medical questions of the day can be debated with the sole object of arriving at the truth. Activity does not necessarily imply progress, nor does tranquillity necessarily denote stagnation; but the movement that proves strength is the movement that generates, fashions, and builds, because it is directed by a definite idea towards a fixed and definite end. The lines of action and the objects of the College are clearly defined in the words of its Charter that have been already quoted. They include all that the most catholic spirit could desire. But it can scarcely be claimed, even in a partisan spirit, that these lines have been completely filled. We need a deeper conviction of the value of this institution, for self-culture, for mutual improvement, and for the benefits it has conferred and confers increasingly upon the community. I might perhaps find language fitting to represent the dignity and responsibility of its position, and to express hopes of its future career which all of its loyal members must entertain. But, lest my earnest convictions and ardent hopes should tempt me to exaggerate, I prefer to repeat the language that was used in the infancy of the College, and nearly a century ago, by the illustrious Rush:—

"By stated meetings as a College, we may promote inquiries and observations upon the prevailing diseases of the city. Here the timid may be encouraged, and the sanguine may be taught to doubt. Here the young practitioner may profit by the experience of the old, and the old by the boldness of inquiry and modern improvements of the young. Here, uniformity in principle, and practice in medicine, will gradually insinuate themselves. Nor

will the advantages of our conferences end in the acquisition of knowledge. The heart will naturally interest itself in the pursuits of the head. Here friendships will be contracted and cemented, and occasional and unavoidable suspicions or disputes may here be accommodated by explanation or mediation. By these means we shall become, not only the guardians of the honor of the profession, but likewise of each other's character."

ENTERIC PARAPLEGIA.

By

ROBERTS BARTHOLOW, M.D., LL.D.,

PROFESSOR OF MATERIA MEDICA AND GENERAL THERAPEUTICS
IN THE JEFFERSON MEDICAL COLLEGE OF PHILADELPHIA.

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By the term enteric paraplegia, I intend to express the conception of a spinal paralysis, produced by an intestinal disorder. It is a truly reflex paralysis. The fact of the existence of such a malady is denied by many, and indeed most of the reported examples will not bear careful inspection, for it will be found, as I shall show, that they are really cases of ascending neuritis. Eliminating such from the examples of true reflex paraplegia to be found recorded, I intend to place the latter in a special group composed of cases presenting the symptoms of an enteric disease, during the course of which, a motor and sensory paraplegia manifests itself, and pursues a course obviously dependent on the original lesions. The cases I have lately seen occurred in men over sixty years of age, and each one presented a morbid complexus so distinctive and uniform as to entitle it to be regarded a substantive affection—a pathological entity. Although such cases have been described as examples of reflex paralysis, they have not been ade-

quately differentiated from others similarly classified, but of different nature.

Before attempting the task of analysis and differentiation, I must give a brief outline of three cases, the most recent which have come under my observation.

Case I.—Mr. R., æt. 64, merchant and banker, of very vigorous and robust frame, rather spare and bony in outline, but capable of great endurance, called on me a year ago, amongst other physicians of this city, for relief to an obstinate bowel affection. His story was this: for a year or more previously he had suffered with intestinal indigestion, colic pains, flatulence, and considerable depression of spirits. Soon after these symptoms were experienced, he began to have pain in the back, with more or less band-like constriction of the abdomen, a feeling of numbness in the feet and legs, a strong sense of fatigue in the inferior extremities, followed by weakness and awkwardness of movements in walking, obstinate constipation, and slowness in the emission of urine. For the relief of these alarming symptoms he consulted an eminent practitioner of this city, who diagnosticated myelitis and advised cups, the moxa, and a pill which probably contained ergot. Without using any of the local applications, Mr. R. took the pills, which had a favorable effect in relieving the flatulence and constipation, but presently dysenteric attacks supervened, and then a remarkable change ensued in the spinal symptoms. Up to this period, the paraplegia had steadily increased, and walking had become exceedingly difficult, but the change in the condition of the intestine effected a revolution in the state of the spinal functions, and in the course of a few weeks, all the paralytic symptoms had disappeared. Still troubled with intestinal indigestion, Mr. R. finally consulted me amongst others, when I learned the details of the case just given. Very recently I have heard that Mr. R. continues free from the spinal symptoms, and has in the main got rid of his intestinal disorder.

Case II.—Mr. P., a tall, thin, but hardy Quaker farmer, æt. 72. I saw the patient at his home near Delta, York Co., this State, in consultation with Dr. Hickman, a very intelligent practitioner living there. I learned that the patient some ten years before had experienced a similar attack, but had recovered rather suddenly under the influence of some remedies which were then prescribed. For some years he remained comparatively free from disorders of digestion. The present attack came on during the past winter; at first there appeared a very considerable disturbance of digestion —acidity, pyrosis, flatulence, and colic pains. The distress was increased by taking food, and apparently attained its maximum when the alimentary materials entered the intestines. In fact the symptoms of intestinal indigestion were the most pronounced throughout, and to these were added obstinate constipation, the stool consisting of balls united by masses of mucus or coated with the same. Very soon after the gastro-intestinal catarrh was established, Mr. P. began to experience numbness of the feet and legs, and an increasing difficulty of locomotion.

At the time of my visit with Dr. Hickman, the patient was nearly entirely disabled. The history of very severe and continuous digestive troubles was repeated. I will, therefore, to occupy as little time as possible, pass on to the objective examination of the paraplegia.

He could not stand without assistance; there was an extreme degree of ataxia; the muscles were so weak that his utmost efforts could not at all hinder slight movement of extension when the legs were flexed on the thigh; the tactile sense was so lowered that the points of the æsthesiometer could not be felt at all; the muscles responded feebly to an induction current; the emission of urine was very slow, and there was much dribbling afterward, and the bowels were extremely sluggish. There was a feeble knee jerk.

With attention directed entirely to the digestive trouble, beginning with an exclusive milk diet, in two weeks a marked improvement was manifest in all the symptoms, the paraplegia disappearing. In a letter recently received from

Dr. Hickman, I learn that, after a period of very great improvement, Mr. P. began to decline in strength, owing to failure of the functions concerned in nutrition.

Case III.—Mr. McK., of Clearfield Co., about 60 years of age, has had for many years frequent attacks of sick-headache. Within the past year, pronounced symptoms of intestinal indigestion, pain of a colicky character, flatulence, and irregular action of the bowels, etc., have come on; but the symptom which has caused the greatest apprehension, and on account of which, more especially, he has called on me, is an increasing numbness with some diminution of power of the inferior extremities. The tactile, pain and temperature senses are not abolished, only slightly impaired, and the tendon reflex is unaffected. A feeling of fatigue, of weight and heaviness is felt in the legs, but locomotion is not as yet much affected. I await further developments in the symptoms referable to the nervous system, but meanwhile treatment is directed to the gastro-intestinal disorder.

Cases similar to those which I have thus briefly outlined have been recorded by various observers. An admirable example, and one of the first of its kind, was narrated by that eminent clinician, Graves, of Dublin (*Clinical Medicine*, edition by Neligan, vol. i. p. 558). In this case extreme gastric disturbance, with less important intestinal, came on in distinct paroxysms, varying in duration from several days to two or three weeks, and accompanied by complete motor paraplegia. For a time, entire recovery took place, the paralysis disappearing with the cessation of the other symptoms. Finally the attacks grew so frequent as to be almost continuous, and death ensued from exhaustion. The minutest examination failed to disclose a lesion in any organ

of the body. With the advance in our means of investigating morbid states, such cases of presumed functional disease of the nervous system are becoming more and more rare. That there is a condition of reflex paraplegia, due to anæmia of the cord, is a postulate I expect to maintain. That there is, however, a so-called reflex paraplegia connected with diseases of the gastro-intestinal and genito-urinary tracts, which is not truly reflex, is another postulate that I believe to be susceptible of demonstration.

There was a period, in England more especially, when the notion of reflex paraplegia secondary to intestinal, renal, and genital disease, was widely entertained. The cases first reported by Stanley (*Medico-Chirurgical Transactions*, vol. xviii. p. 260), Brodie (*Lectures on Urinary Organs*, p. 115), Stokes (*Practice of Medicine, Treatment of Nervous Diseases*), Graves, and others were supplemented by the striking narratives of Gull (*Guy's Hospital Reports*, various papers). Then Brown-Séquard (*Lectures on Paralysis, etc.* 1861) gave a scientific explanation of the mechanism, referring the paralysis to vasomotor action. It must be admitted, nevertheless, that the doctrine of a reflex paralysis has not maintained the position it once had. In no modern work is the subject treated with the extent and gravity befitting an important disease.

The two postulates I purpose to sustain are:—

1. That there is a reflex paraplegia due to a functional disturbance of the intestine—enteric paraplegia.

2. That there is a paraplegia having its initial seat in the end-organs of the nerves distributed to

the mucous membrane, thence ascending to the cord by a progressive neuritis.

As respects the first postulate, the cases I have narrated, and many others on record, demonstrate a causal connection between the enteric disorder and the spinal. That the paraplegia is functional is proved by its prompt cessation, when the cause is removed. One of the means of determining whether a given paraplegia is due to a myelitis, or to mere anæmia—that is, functional—is the subcutaneous injection of strychnine. At a late meeting of the American Neurological Association, Dr. Jewell, of Chicago, recounted his experiences with considerable doses of strychnine, in cases of paraplegia, which improved so remarkably, that they must have belonged to the merely functional group. It is in a high degree probable that cases of merely reflex paraplegia — of enteric paraplegia — especially as they occur in aged subjects, are relatively frequent, and happen from a degree of intestinal disturbance, that seems a mere accident of the morbid complexus.

What is the mechanism? We are helped in our consideration of this question by physiological data. Kussmaul and Tenner (quoted by Erb) have shown that sufficient loss of blood will cause paraplegia. Tying the abdominal aorta, and its obstruction by disease, of which Gull (*Guy's Hospital Reports*, 1858, p. 311) has given a striking example; embolic blocking of the spinal vessels, as Panum (*Virchow's Archiv*, Band xxv.) has experimentally demonstrated; and large uterine hemorrhage, as Moutard-Martin (*L'Union Médicale*, 1852) has shown, have alike stopped the spinal cord functioning. In other words,

an insufficient blood supply—an anæmia—is a cause of paraplegia. Brown Séquard, in his Lectures published in 1861, maintained the thesis that a strong contraction of the vessels of the cord induced by reflex stimulation is the essential condition in reflex paraplegia. We should not lose sight, in this connection, of the degree of stimulation necessary. A moderate degree of intestinal irritation suffices—for the law of reflex contraction of the vaso-motor fibres may be formulated thus: irritation of the end organs of the sensory nerves, not too violent and long-continued, stimulates the vaso-motor centre in the medulla, and causes a general contraction of the arterioles; but excessive and protracted irritation depresses the vaso-motor centre and relaxes the vessels. It seems probable that an ordinary intestinal indigestion and the stretching of the nerve fibres produced by retained gas is a degree of irritation sufficient to produce the supposed effect. To the further elucidation of the mechanism of enteric paraplegia, it is necessary to recall the fact that the blood pressure in the vessels of the intra-abdominal organs rises and falls within considerable limits in quite an independent manner, controlled, doubtless, by the same ganglia that regulate the calibre of the intra-spinal bloodvessels.

The circulation within the spinal canal is peculiar, in that the veins bear such a disproportionate volume to the arteries, and that the whole vascular supply is in a certain sense a diverticulum. Atheroma of the vessels will contribute to the result of reflex irritation, and hence it is that paraplegia has resulted from endarteritis of the spinal vessels.

The second postulate is that the paraplegia which

succeeds to certain cases of enteric, renal, or genital disease, is due to an ascending neuritis. Chronic dysentery, pyelitis, and vesical catarrh are affections during the course of which the spinal cord has become diseased. Lesions of continuity involving the terminal nerves in structural changes are necessary to the production of this effect. The part which ascending neuritis may play in causing anatomical alterations of the spinal cord is exhaustively shown by Friedreich in his monumental work on progressive muscular atrophy (*Ueber progressive Muskelatrophie, über wahre und falsche Muskelhypertrophie*, Berlin, 1873, Hirschwald). Whether we accept his conclusions or deny them, we cannot withhold the full measure of admiration for his labors. Starting with the theory of an intramuscular neuritis, Friedreich holds that, by an extension of this affection upwards, the cord is ultimately reached, and the changes belonging to progressive muscular atrophy are wrought. The intramuscular neuritis admitted, the rest may easily follow. Under the term "Chronic Ascending Neuritis," Dumenil has described the changes in injured nerves which, caused by trauma, proceed from the point of injury up to and involve the cord. Vulpian has especially demonstrated the modifications produced in the spinal cord by the section of a principal nerve in a member, usually the sciatic (*Archives de Physiologie Normale et Pathologique*, No. 3, 1868, p. 443). The nerves of a limb amputated, as Dickinson has especially shown, undergo degenerative atrophy, and that part of the spinal cord in anatomical connection therewith also atrophies. Many other observations might be quoted, but these will suffice

to show how changes in the cord follow injuries to peripheral nerves.

In paraplegia secondary to ulceration of the mucous membrane, we can readily, I think, conceive of a lesion of the peripheral nerves and an ascending neuritis to which the succeeding changes are due. It follows that such cases require a very different prognosis from those of simple reflex paralysis. The course and termination of the latter are affected by the causal lesions, whilst the former pursue a steadily unfavorable direction from the beginning of the spinal symptoms. The differentiation of reflex from secondary paraplegia is made by attention to the following points:—

Reflex paraplegia is sudden in its onset, or, at least, develops quickly; secondary paraplegia is gradual in its evolution; the former is soon complete in all points of its symptomatology; the latter attacks one spinal function at a time. Reflex paraplegia follows the fortunes of the producing malady; secondary paraplegia pursues an independent course, and when the alterations begin in the spinal elements, they proceed in their own way, just as, after amputation of a limb, the changes in the cord go on in the associated nerve fibres, or, as in Landry's ascending paralysis, the lesions proceed by contignity of tissue. Reflex paraplegia, of and by itself, never proves fatal, nor does it inflict permanent damage; secondary paraplegia may be the cause of death, and, if not fatal, effects lasting mischief.

To this view of reflex paraplegia it may be objected, that extreme variations in the vascular supply must ultimately lead to structural changes. This is

certainly possible, but the spinal, like the cerebral circulation, is arranged to permit considerable variations in the amount of blood.

It remains to explain, if an explanation be possible, why intestinal or renal lesions may in one case produce a merely reflex disturbance, and in another, set up an ascending neuritis. There are, probably, two reasons: 1st. The depth and extent of the peripheric lesions; 2d. An inherent susceptibility to degenerative changes in the nervous elements. The first to me has profound significance, and I have already alluded to it. A degree of peripheric irritation not too great will merely stimulate the vaso-motor centres, and cause anæmia of the cord by tonic contraction of its vessels, but when the lesions of the mucous membrane are of a destructive kind, depression of the trophic centres, as well as of the vaso-motor, ensues. That there is a neuropathic type of constitution, in which the nerve tissues are peculiarly prone to take on morbid changes, is an indisputable fact. When the two influences coincide, the result is not doubtful.

I must, then, conclude that there is a malady, which may properly be entitled *Enteric Paraplegia.*

REPORT

OF A

CASE OF ABDOMINAL TUMOR, SOMEWHAT RESEMBLING PREGNANCY, IN A YOUNG MARRIED WOMAN.

By

JOHN H. PACKARD, M.D.,

SURGEON TO THE EPISCOPAL HOSPITAL AND TO ST. JOSEPH'S HOSPITAL.

[Read December 5, 1883.]

I VENTURE to hope that the following report of a case presenting some unusual features may be of sufficient interest to warrant me in bringing it before the College:—

Mrs. G., æt. 21, a very slim and delicate-looking woman, consulted me on the 21st of July in regard to a slight and uniform abdominal enlargement, which had been first noticed by her shortly after her marriage about three months previously, and had been gradually and steadily increasing. She menstruated regularly every month, and had had no nausea. Neither the breasts nor the nipples showed any change from the virgin state.

There was no tenderness at any point in the abdomen, and the appearance and feel of the swelling were very much such as would be presented in the early stages of pregnancy.

On the 26th I saw her again, and made an examination per vaginam. The os uteri was soft, and the cervix was of some

length; but there was a bulging above, as if the uterus contained a mass partly solid and partly liquid. I did not of course think it right at this time to introduce a sound, as, in spite of the absence of rational signs, the presumption seemed to me to be in favor of pregnancy. One fact seemed to militate against this view, viz., that she rather lost than gained flesh.

I declined to express any opinion as to the character of the swelling, but told the husband that my hope was that the case would prove to be one of pregnancy, as it was likely otherwise to be very grave.

There was a good deal of pain on either side of the hypogastrium, apparently due to tension of the muscles; this was temporarily relieved by the use of chloroform liniment. She had very little appetite, and I gave her a tonic composed of nux vomica and gentian.

The swelling continued to progress steadily, and on September 13th she presented the appearance of being at about the middle of the fifth month of gestation. The hypogastric pain troubled her greatly, and was only allayed for a very short time after each application of the liniment.

At the desire of the family, I now asked and obtained the advice of Dr. Ellwood Wilson, who saw her with me on September 15th.

In the forty-eight hours which had elapsed between my previous visit and this one, a very marked change had taken place. The abdomen had become greatly enlarged, its walls forming one curve from the ensiform cartilage to the pubes; there was very decided fluctuation, and percussion showed an area of dulness which was attributed by Dr. Wilson to the existence of a cystic tumor connected either with the Fallopian tube, or with the broad ligament. A sound was introduced into the uterus, the cavity of which was found to be unoccupied. Dr. Wilson advised the drawing off of the liquid, which was accordingly done by aspiration, on the 17th. More than a gallon of ropy yellow liquid, somewhat deeply tinged with blood, was thus removed; the flow then

ceased, and the end of the canula encountered a solid substance, apparently a septum of considerable thickness. Upon the withdrawal of the instrument, a fresh flow took place, the liquid spouting out from the orifice to a distance of several inches. When this subsided, the abdomen, which was much less tense, was covered with raw cotton, and a bandage carefully and firmly applied.

During the operation the patient became quite faint, but rallied after the administration of a little brandy and water. In the evening her temperature rose to 103.5°, but before morning it fell to about 100°. She slept very little, and complained of much pain, due partly to the stiffening of the cotton and bandage by the agglutination of some of the liquid which oozed from the belly. On examining the wound in the morning it was found closed.

The following evening the temperature again rose to 103.5, but subsided again before morning, and was not thereafter above 99°. Yet her condition was unsatisfactory; her face was much pinched, and anxious; she had very little appetite or ability to take food; at times her mind wandered slightly, and she slept but little. Vomiting occurred frequently, and she was seldom free from nausea. Her bowels acted regularly; her urine was free, and normal in every respect. Her pulse varied, but was generally from 110 to 120.

Beef-tea, milk, with brandy and limewater, and champagne, were given at as short intervals as the stomach could bear them, and at stated times. External warmth was carefully kept up.

It was determined that should symptoms of peritonitis present themselves, ovariotomy should be at once resorted to.

A portion of the liquid was submitted to Dr. H. F. Formad for examination, and his report, which was not received until some time after the case had terminated, was: "I think it very doubtful that it comes from an ovarian cyst, the fluid showing very little epithelium, and very few of the ovarian cells of Drysdale."

September 23, her condition was very much more favorable;

her mind was composed and even cheerful, her pulse and temperature good. Some food had been taken and retained.

On the 24th her state was much the same, and it was thought proper to entertain the idea of an operation for the removal of the supposed ovarian tumor. In the afternoon Dr. Agnew saw her with Dr. Wilson and myself, and it was decided that the attempt should be made on the following day.

Accordingly, on the 25th, at noon, ether was administered by Dr. G. P. Sargent, of Bryn Mawr, and in the presence of Drs. Wilson and Agnew, I opened the abdomen by an incision in the median line. After dividing the wall I came to what seemed to be a cyst, and passed in an ovariotomy trocar, when a very free evacuation of liquid, straw-colored and ropy, but clear, took place. It was now apparent that the liquid was contained in the peritoneal cavity, and that there was a large solid mass lying among the intestines. This tumor was soft and doughy, like a placenta; it seemed to belong to the mesentery, since although somewhat movable, it was firmly attached to the posterior wall of the abdomen, rather high up. The surface of the mass having been slightly lacerated, there was somewhat free bleeding, which was checked with some difficulty by ligation with carbolized catgut, and by the application of a cautery-iron.

The wound was now closed with two large pins and a ligature cast around them, and with metallic sutures; a sheet of raw cotton was applied over the whole belly, and secured by a bandage.

The patient rallied considerably, and after the effects of the ether had passed off became quite sensible; but she soon began to sink, and died on the 27th, about forty-eight hours after the operation.

No autopsy could be obtained, so that the exact nature and connections of the tumor must remain a matter of conjecture.

The notable points in the case now detailed seem to me to be the occurrence of a solid tumor, probably

of malignant character, and apparently connected with the mesentery, in a young woman recently married; its resemblance in its physical appearances to the pregnant womb; the very sudden change that took place by a fresh effusion into the peritoneal cavity, and the obscurity which even then existed as to the real nature of the case. Even with the most accurate diagnosis, effective treatment would have been out of the question, and I cannot but think that my suspicion of pregnancy, erroneous as it proved to be, really prolonged the patient's life, which would have been almost necessarily sacrificed by earlier interference.

CRITICISMS ON THE SPECIFIC THEORY OF HYDROPHOBIA.

By

CHARLES W. DULLES, M.D.,

SURGICAL REGISTRAR TO THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA.

[Read December 5, 1883.]

NEARLY two years ago I had the painful experience of being summoned one day to take charge of a boy who was suffering with what is called hydrophobia. The unfortunate patient was under my care and observation less than twelve hours, when he died. The horrors of that day can only be understood by those who have had a similar experience. To stand in the presence of such distressing psychical disturbance, to see death advancing relentlessly, to feel that science furnishes no satisfactory explanation of the nature of the disorder and offers no trustworthy remedy for its treatment—this was a trial of mind which intensified the weariness of body which the circumstances necessarily entailed. The details of the case were read before the West Philadelphia Medical Society, and are recorded in the *Medical News*, May 27, 1882. There can be found all the points which at the time most impressed me. There, too, are recorded the theoretical and practical notions in regard to hydrophobia which I had at that time.

Later, on May 23, 1883, I read before the Philadelphia County Medical Society a paper entitled "Remarks on Hydrophobia," which was published in the *Philadelphia Med. Times*, Aug. 11, 1883. In this are set down some of the conclusions which I had reached after more than a year's study of the literature of the subject. The point aimed at in that communication was to attract the attention of those who heard me to the extremely unsatisfactory condition of our knowledge in regard to this disorder, and to lodge in their minds the suspicion that the views so ordinarily held, and so positively stated in most of the text-books, are not as clearly established as most people believe. In concluding the discussion which followed in the Society, I stated all I wished to, at that time, of my own convictions, in the expression that "but little of the evidence upon which it (the commonly accepted theory of hydrophobia) rests, can be regarded as having *an accuracy and reliability commensurate with the delicateness and gravity of the questions at issue.*" Since then I have continued my investigations, and the wider their extent has grown the firmer has become my belief that this statement was the very mildest that could have been used without sacrificing the truth. But, I have learned by reading, and by experience, that those who differ from the majority are in danger of being treated to a certain amount of disdain for their inability to accept as evidence what to others seems acceptable enough. For example, Dr. Parry, in his interesting work on *Cases of Tetanus and Rabies Contagiosa*, published in London, 1814, indicates his sentiments as follows: "It was formerly doubted whether any such disease

as Canine Hydrophobia existed;" and I have heard that the question was once solemnly debated in a society, which, after a long discussion, determined it in the negative by a majority of voices. The existence of the Giraffa, or Camelopardalis, was long denied by the moderns, not only notwithstanding the accounts given of it by the ancients, and its delineation on the Prænestine pavement, but after its skin was actually to be seen dried and stuffed in a Dutch museum. We are told of a king of Siam, who, after he had heard with patient attention certain wonders from a European ambassador, and was at last informed by him, that in his country, at certain seasons of the year, water became solid, and was capable, not only of being cut or broken, but of admitting his Majesty and his whole court to walk over it without wetting their feet, flew into a violent passion, exclaiming, "For a long while, notwithstanding the prodigies you have related to me, I thought you were an honest man; but now I am sure that you are an impudent liar." In this story, the intimation that our knowledge about hydrophobia has reached the "dried-and-stuffed" stage goes well with the other intimation, that the skeptics in regard to it are in the state of ignorance comparable to that of the king of Siam.

Later than Dr. Parry, but still in this century, Dr. Copland set the stamp of his learning on the doubters thus: "The supposition lately published that there is no such specific disease as rabies, and that it is merely the result of mental anxiety, etc., is only one of the absurdities thrown up on the surface of medi-

cal doctrine, and hardly deserves mention, and much less serious refutation."

But scientific questions are not settled in this summary way, nor has the fear of being thought singular ever long deterred men from asserting what they had come to hold as convictions. That which has been branded as an absurdity has, over and over again in the history of the world, come to be established as a fact, and the same may yet be accomplished for the opinion of those who deny the specific nature of rabies or hydrophobia. One thing is sure, viz., that the attitude of severe criticism seems to offer the only hope for the solution of the riddle of hydrophobia; since, in more than two thousand years, the acceptation and repetition of authoritative opinions has failed to furnish a theory which does not fly in the face of all analogy, or a practice which holds out a reasonable hope of saving a single life. Such is the real state of knowledge in regard to hydrophobia. The theories as to its nature are contradictory and illogical; the teachings as to its treatment are without the slightest hope of success. In regard to both, the ablest men who have discussed it occasionally or systematically are in irreconcilable opposition. While some hold to certain modes of communication, others strenuously deny them. While some admit its spontaneous origin, others will not admit it for a moment. While some think the virus is to be found in the saliva, the blood, the bronchial mucus, the milk, the flesh of rabid animals, others limit it to the first of these alone. In regard to the period of incubation the widest divergence of opinion exists. The range is from one day to forty years, and no one seems to

have been able to fix a limit to either its shortness or its length. Equal contradiction meets the gaze when one turns to the matter of treatment. From the throwing into a fish-pond, as practised by Celsus, to the inhalation of oxygen, as recently practised by Drs. Schmidt and Zebeden, there is a variety of methods which demonstrates how utterly every attempt to find a specific has lacked the guidance of any accurate idea as to the nature of the disorder. To almost any statement of men whose names are highly respected in medicine, may be opposed the most positive and contradictory statements of others equally respected. Virchow admits (*Handb. d. Spec. Path. und Therap.* "*Wuthkrankheit und Wasserscheu*") that hydrophobia may be communicated by means of weapons used to kill mad dogs with, and by blood-letting and scarifying instruments—a belief which, but for Virchow's adherence to it, would be correctly designated as obsolete, and which is entirely unworthy of acceptation. Bollinger, a distinguished veterinarian, admits (Ziemssen's *Cyclop.*, art. "Hydrophobia") the possibility of infection by the migrations of animal parasites, such as fleas and lice.[1]

The late Dr. George B. Wood admitted the possibility of hydrophobia being caused by the bite of birds, and explains why this does not often occur as owing to the fact that these animals, like horses,

[1] This curious idea is founded upon a reference, which, when I hunted it up, I found to be a pure assumption of a Dr. M'Crae (*Lancet*, March 23, 1872, p. 420) that the occurrence of smallpox thirteen miles northeast from Melbourne, where it was also present, was to be accounted for only on the supposition that it was conveyed by flies. It has been interesting to observe, in my own investigations, how this supposition of Dr. M'Crae's has grown to a statement of an established fact, as it has been quoted by foreign writers.

asses, and oxen, do not usually bite. (*Practice of Medicine*, vol. ii. art. "Hydrophobia.") In view of these facts it will not seem so remarkable that Sauvages believed the eyes of hydrophobic patients to shine at night like those of cats, or that he should explain this on "meaque de hydrophobia theoria, quæ admittit in hoc morbo fluidum illud in phosphoricam activitatem exaltatum." (*Nosologia Methodica: Vesaniæ*, vol. ii. p. 232.) Nor can one wonder that Mead, about a hundred years ago, should have said: "The influence of the moon in these cases, I am convinced, is of some weight." (*Medical Works*, art. "Hydrophobia," p. 62.)

But, to return to modern times, what shall one think of the attempt of Doléris, the author of the, in many respects, admirable article on this subject in the *Nouveau Dictionnaire de Médecine et de Chirurgie* (1881), to explain the assertion of the occurrence of spontaneous cases by saying that the disorder may be acquired from germs distributed in the air and earth, like "charbon?" Or, how shall we consider the willingness of Sir Thomas Watson (*Nineteenth Century Review*, Dec. 1877) to accept the occurrence of hydrophobia by the infection of sucklings through the medium of the mother's milk, or his statement that the disorder does not occur in Constantinople or Africa? In both which places it does occur.

But I do not wish to make too much of this aspect of the literature of hydrophobia. I wish to call your attention to the cause of the uncertainties which prevail in regard to it. This is, in my opinion, easy to point out. It is the too great readiness to accept any

sort of testimony which may be offered as bearing upon the subject. This fault is to be found in almost all the works treating of hydrophobia, from the earliest ages to the present time. This led Pliny to father such absurdities as the following: "There is a small worm in a dog's tongue, known as 'lytta' to the Greeks; if this is removed from the animal while a pup, it will never become mad or lose its appetite. This worm, after being carried thrice round a fire, is given to persons who have been bitten by a mad dog to prevent them from becoming mad. This madness, too, is prevented by eating a cock's brains; but the virtue of these brains lasts for one year only, and no more." And, again, "So virulent is the poison of the mad dog, that its very urine even, if trod upon, is injurious, more particularly if the person has any ulcerous sores about him. The proper remedy in such a case is to apply horse-dung, sprinkled with vinegar, and warmed in a fig." (Pliny, *Natural History*, book xxix. chap. 32. Trans. by Bostock and Riley.) This same too easy acceptance of testimony led such a writer as Dr. Samuel Bardsley, in 1807, to accept the statement that hydrophobia could be communicated by the mere application of the saliva to the unbroken skin, and to cite with apparent approval a story of a man who had hydrophobia from kissing a mad dog previous to its being hanged. (Samuel Argent Bardsley, *Med. Reports*, London, 1807.) And, most recently, it has led Bollinger, already referred to, to attribute the disorder to drinking the milk of an affected animal, and to the act of coitus. (*Ziemssen's Cyclopædia*, 1875.) While Mr. Williams, in his valuable work on *Veterinary Medicine*, 3d ed. 1882, says rabies can be com-

municated through a "thin epidermis without wound or abrasion."

These citations illustrate the most remarkable feature of the literature of hydrophobia. It would seem as if the mind, when once it has accepted a theory which contradicts all experience in other and fairly well-understood diseases, loses the ability to distinguish good evidence from bad. A striking illustration of this is furnished by Dr. Dolan in his otherwise capital book on *Hydrophobia or Rabies.* In his second chapter this writer calls attention in detail to the rules laid down by Dr. Abercrombie in his *Inquiries concerning the Intellectual Powers and the Investigations of Truth.* These warn against the following fallacies: 1. Receiving as facts statements which are not facts, but opinions. 2. Receiving as facts statements which only assume the relation of facts. 3. Receiving as facts general statements, or the generalization of facts. Dr. Dolan then says: "Some writers, for instance, have maintained with much confidence that a particular state of rigidity of some of the limbs is distinctly characteristic of *ramollissement* of the brain. But further observation has shown that the disease may exist without this symptom, and that this condition of the limbs may appear in connection with other diseases. This observation of facts was in so far correct that this state of limbs does very often accompany *ramollissement* of the brain; the error consisted in giving it as a general fact, or a fact applicable to all cases of *ramollissement*, which is without foundation. Yet such statements, when brought forward with confidence, are often received as facts and

rested upon as established principles; and then the facts by which their fallacy might be detected are apt to be overlooked or forgotten." To this reference to the commonest sources of fallacy Dr. Dolan adds: "We are arming our readers against ourselves." And yet he goes on, apparently with his eyes wide open, to reproduce the fault he has just pointed out in speaking of *ramollissement*, accepting statements which ought not to be entertained for a moment in the discussion of so grave and delicate a subject, and admitting as genuine cases which are transparently spurious. I will give an example of this latter mistake, which illustrates several points at once. Dr. Dolan gives, in his collection of cases, and, after sifting his material, stamps as genuine, the following from Romberg's *Diseases of the Nervous System.*

"Case LXXIV.—Frederick L., male, æt. 6, bitten on the second finger of the left hand by a dog which had already bitten several other children. Result and time of attack, three months; fatal third day.

"*Treatment.*—A few of the dog's hairs had been cut off to place upon the wound, which in eight days was completely healed. The treatment consisted in taking twelve ounces of blood from the arm, scarifying, and applying cantharides ointment to the cicatrix, rubbing in a scruple of mercurial ointment into the inner surface of the left arm. Dr. Horn also visited the boy, and described his features as expressive of extreme anxiety, while his eyes told a tale of immeasurable misery. He implored that he might not be touched or bled again, as he desired nothing more than to be allowed perfect rest." The post-mortem was made on the 4th Sept. 1820, twenty-five hours after death. The smell of putrefaction was already developed. The muscles were dark red. The lungs were charged with blood. The larynx, the trachea,

and œsophagus were not abnormal in appearance. But, the record says, "the redness of the heart was remarkable, the arteries and veins on its surface looking as if they had been injected. The mitral and aortic valves presented a scarlet hue, the trabeculæ carneæ were darker than usual, the internal surface of the aorta was of a bright red hue as far as the arch, the blood contained in the vessels was dark and fluid, the inner surface of the stomach was as pale as that of the œsophagus. No morbid change was found in any other abdominal organ. At the urgent request of the parents the head was not examined."

The history of this case, as originally described in Romberg's book (*Nervous Diseases*, translation, London, 1853), taken together with the post-mortem appearances, seems to me to show it to have been one of acute endocarditis, probably septicæmic. But no such idea seems to have entered the heads of the physicians who attended it. As a case of hydrophobia they went most heroically to work to treat it.

Picture to yourselves the scene. Think of that little child, only six years old, tested with the useless and dangerous tests of handwashing, and mirror, and with urine sprinkled on his skin—the former showing nothing, the latter causing a paroxysm. Think of his being bled, the cicatrix being scarified and blistered with cantharides, and mercurial ointment being rubbed into his arm. Then fancy him, when the doctors came at him after an interval, imploring only to be left in peace, whilst they, with grim determination, bled him again and dosed him with calomel, after which—to quote Romberg literally—"death came to his relief."

In reporting this as a case of hydrophobia, Dr.

Dolan has followed the opinion of Romberg, who, when he recorded it, had *never before seen a case.* But it strikes me as a very piteous illustration of the truth of what White said (*Doubts of Hydrophobia*, London, 1826) of the course of many cases. He described the usual alarm, the fear of the patient, the suspicion of the doctor, the test with water, the melancholy conviction of doctor and patient, adding: "the patient and himself, therefore, will soon *make out a case*—the one dies, and the other publishes an account of his end." Does it seem unfair to apply such an expression to such a case as has just been cited? On the contrary, does not the history of the case indicate that general eminence in medical science gives no guarantee of infallibility when this vexed subject is approached?

I have selected an illustration of the point I wished to make which should include two names well known and justly distinguished, because their very excellences add force to the proof they furnish that the prepossession of a theory which at the outset demands a certain surrender of the judgment will impair the freedom of the judgment at every subsequent step. Such, it seems to me, is the condition in which every believer in the specific nature of hydrophobia stands. The assumption of a specific virus which, and which alone, is the originator of the disease in any individual compels its adherents to bend their judgment to accept the belief that there is a virus which behaves in a way contradictory to that of every other virus about which we have any positive knowledge. As Lorinser has said (*Wien Med. Wochenschrift*, 1874), "We know very well the ap-

pearances produced, for example, by the bite of poisonous serpents, or by the poisoning of wounds with the poison of glanders, anthrax, syphilis, or cadaveric poison. There are, in general, always the manifestations of more or less rapidly developed inflammation, and of further distribution of the poison through the lymphatics, veins, and lymphatic glands, which organs then, in like manner, manifest similar inflammatory symptoms. Nothing of the kind do we see in wounds made by the bites of mad dogs," etc. And, again: "We know, in all pathology, not a single infective disease which, in regard to the time and symptoms of development, bears the slightest resemblance to hydrophobia."

One might suppose that such a contradiction would lead observers to be constantly on the look-out to find some other way of explaining the phenomena of hydrophobia, and that everything that was presented as evidence in support of it would be subjected to the most rigid scrutiny. But the literature of the subject shows that the very opposite is the case. The *post hoc propter hoc* argument is the one which rules here. A careful perusal of a large number of recorded cases leaves the impression that they have not been studied with any idea that they might be something else than what they appeared to be. Though it is no secret that the dread of water is a symptom of a great variety of affections, one finds over and over again the ablest men resting a diagnosis on this which is acknowledged by most systematic writers to be the least reliable of its signs. Another thing which has struck me in examining the records of cases is the readiness with which reporters, aware of the objec-

tion, so often raised, of the effect of mental influence, accept the statements of friends or the silence of patients in regard to it as evidence that it does not exist. I will give an example of this. In the *Berliner Klin. Wochenschrift*, September 15, 1879, Dr. Findeisen reports a case of a man who died of hydrophobia, and who is positively stated not to have known that the dog that bit him was mad, or to suspect that he had hydrophobia, or connect his disease with the bite. Yet the record states that, on the second day of his disorder, he cried out that he had been bitten by the "poisonous (*giftiger*) dog," and was not crazy.

Another curious thing, to be observed in the literature of hydrophobia, is the way in which the madness of the dog is often—one might say usually—deduced from the diagnosis of hydrophobia in the man; instead of the diagnosis of hydrophobia being made to rest upon reliable evidence that the dog was really mad. It is uncommon to find any proof whatever that a dog to which hydrophobia is attributed was rabid, this being, with rare exceptions, a pure assumption. The one phenomenon of a dread of water usually determines the conviction of the physician that he has a case of hydrophobia before him, and settles his opinion of any dog that may ever have bitten the patient, and cannot now be accounted for. Nay, more, this mode of reasoning has led certain writers to the assertion that there may be a passing state in dogs in which they may communicate to a human being hydrophobia, but themselves recover. Thus is the struggle to support the specific theory kept up when circumstances seem to be most adverse to it.

Once more, and I am done for this occasion with

objections to the anomalies which one meets in examining the basis upon which the general belief in regard to hydrophobia rests. I find in the recorded cases —with very rare exceptions—that, when once hydrophobia is suspected, every phenomenon that occurs during life, every lesion that is found post-mortem, is unhesitatingly set down as a feature of this disorder; and the idea does not seem to be entertained that many of them are grounds of suspicion that some other disorder is present. In this way all lines of distinction between hydrophobia and disorders which simulate it are erased; and it remains for every medical man who is called to a patient who has a dread of water, accompanied with exaltation of reflex excitability, to inquire for a bite or scratch of a dog or cat; if one cannot be drawn out, to assume that it has been received and forgotten; then to make a diagnosis of hydrophobia; after which it is only necessary for the patient to die to make a complete record. If to this be added a careful microscopical examination of the state of the brain and spinal cord, the observer will have an exact counterpart of the process by which the famous conclusions of certain investigators—often quoted by those who have not taken the pains to go to the evidence upon which they are founded—were arrived at.

This suggests a brief consideration of the pathological lesions of hydrophobia. Notwithstanding all the diligent endeavors made to learn something from the post-mortem examination of the bodies of dogs and men that have died of rabies or hydrophobia, one might to-day adopt the language of Dr. Hart, who declares (*Cooper's Surgical Dictionary*, art.

"Hydrophobia") that these examinations afford "little else than a varied mass of symptoms, common to other nervous and blood disorders," and fail to "throw any clear light on the pathology of the disease."

I will not trouble you with the disappointed anticipations of the ancients in this connection; those of modern times are more instructive. The announcement by Hallier, in 1872, of the discovery of a micrococcus which was the germ of hydrophobia, and to which he gave the positive name of "lyssophyton," and the belief of Klebs in the parasitic nature of the granular elements found around the bloodvessels near the scar, have appeared and disappeared within the last decade. The hasty statement of Pasteur that he had obtained from the saliva of a patient dying of rabies a peculiar germ which, when he had cultivated it and inoculated the product, gave rise to a hitherto unknown disease, he was compelled to withdraw almost as soon as he had made it.[1]

The investigations of Benedikt, Coats, and Gowers are of the greatest interest in connection with this part of our subject. They are often spoken of as if their results were identical and conclusive; although, in fact, they are neither. Dr. Benedikt published his investigations in 1875, in *Virchow's Archiv*. The text is accompanied with a plate which leaves little room for misunderstanding the author's meaning. The

[1] Nothing daunted by the experience of others, I observe that Dr. Paul Gibier reported to the Acad. des Sciences, of Paris, on the 11th of June, 1883, that he had found a special organism in the rachidian fluid of animals that had died of rabies, and that the virus could be attenuated by means of cold. Another of the conclusions he announced at that time was that the disease is communicable from mother to fœtus.

lesions described and figured consist of a perivascular exudation or extravasation (or both) of *red* blood-corpuscles, miliary spots of finely granular degeneration of the brain substance, "miliary abscesses," and melting down of effusions so as to make hyaline bodies alongside of the bloodvessels, often closing their lumen; while the vessels had a pigmented encasement (Pigmenthülle), made up of red blood-corpuscles. These lesions were found in both dogs and men. Dr. Coats published his discoveries in the *Medico-Chirurgical Transactions*, in 1878, accompanied also with plates. His investigations referred to tetanus and hydrophobia. He makes a point of the analogies between these two disorders; and, assuming a virus in hydrophobia, he argues backwards that there is a poison circulating in the blood in tetanus. The lesions he describes in hydrophobia consist of a perivascular infiltration with *white* blood-corpuscles.

In comparing these investigations, it is to be noted that the lesions Coats found in tetanus correspond much more closely with those Benedikt found in hydrophobia than do those the former found in his investigation of this latter disorder. Further, it is to be noted that he describes the perivascular infiltrate as consisting of *white* corpuscles, while Benedikt is clear in describing it as made up of *red* corpuscles. Finally, Coats does not consider (though most persons who refer to him speak as if he did) the lesions he found to be distinctive of hydrophobia, but simply evidence of irritation in the blood. Thus we see that these two investigators cannot be regarded as confirming each other.

Now the association of the name of Dr. Gowers

(whose investigations are described and illustrated in the *Transactions of the Pathological Society of London*, vol. xxviii. 1877) with those of Benedikt and Coats, as having found lesions pathognomonic of hydrophobia, is equally unwarranted, for he distinctly stated, in answer to a question, at the meeting where he demonstrated his specimens (*Lancet*, June 9, 1877, p. 840), that his investigation did not lead him to believe there was any special lesion in hydrophobia.

But, inconclusive and conflicting as the results of all these careful investigations have been, it might be easy to see how they might be taken for more than they are worth, if it were not for the fact that they have been formally and categorically vitiated by the subsequent investigations of others. Thus, Middleton (*Journal of Anatomy and Physiology*, 1881) has published the results of microscopical examinations in which he found perivascular aggregations of round-cells in two cases of hydrophobia, corroborating some of the appearances described by Benedikt, but disagreeing with Coats and Kolesnikoff in essential points. But the most striking point of his publication lies in the fact that he found the same morbid appearances which were present in the cases of hydrophobia in cases of purpura hemorrhagica, diabetes, fracture of the skull, erysipelas, head injury with hæmatoma, concussion of the brain with fracture of the spine, delirium tremens, peritonitis, tubercular meningitis, mental deficiency and excitement, hæmatoma, tetanus, and uræmia. His paper concludes with the distinct avowal that, "as regards the pathology

of hydrophobia, it still remains true that nothing characteristic has been observed."

Another investigator, who has gone over this ground, and come to conclusions as destructive as those of Middleton, is Ivanoff, who says (*London Medical Record*, March 15, 1883, from *Vratch*, 1882, No. 15), that appearances similar to those observed by Benedikt, Gowers, and others are found in typhoid fever. One of the supposed characteristics, the transparent spaces, he says, was found by Popoff and Stephanoff in uræmia, and by Vinogradoff in intermittent fever, by Danillo in phosphorus poisoning, and by himself and Dr. Czorkov in the brains of healthy dogs. They have no pathological character whatever.

But I need not detain you with further references to more or less famous investigations. I will only add that they all tend to confirm the opinion that as yet no gross or microscopical lesion has been discovered which can be regarded as pathognomonic of rabies or hydrophobia.

And now I must close. I have not said so much because it is any pleasanter or is likely to be any easier for me than for others to differ from the majority in the branch of science to which my life is given. It is with shrinking that I take a position which, if it is deemed worthy of notice, will be apt to excite opposition, perhaps condemnation. But I have now been engaged for nearly two years in a laborious study of the evidences upon which the general belief in regard to hydrophobia rests, and I have been gradually led to certain convictions different from those with which I started, and which I feel it my

duty to make public. One of these is that hydrophobia is not a specific, inoculable disease, derived from the bite of a similarly affected animal. Another is that if we wish to have an accurate, scientific knowlege of what too often actually takes place, and is usually called hydrophobia, we must begin the study of it unprejudiced by the views heretofore generally entertained in regard to it, and with canons of criticism very different from those heretofore deemed sufficient.

I know that these convictions are not novel, and that they have been stated and defended with arguments before. I know, too, that they have heretofore failed to secure the assent of the greatest men who in every generation have adorned the profession of medicine. None the less, however, do I believe that they are true, and that the time will come when they will not be—as they have been in the past—characterized as too absurd to be discussed, or decried as too dangerous to be tolerated.

But, however that may be, a sense of duty compels me to join myself to the small minority whom I think to be on the right side of the question, for truth's sake. Further, in this matter, the interests of science are in an urgent sense the interests of humanity. For this reason one who feels strongly must speak boldly. This, then, is my apology to those who may think I have erred in opposing the opinion of so many men deservedly honored and respected in our profession.

[After the reading of the preceding paper:—]

Dr. HENRY HARTSHORNE observed that the author of the paper has given an interesting philosophical analysis of the confusion and uncertainty attaching to much of the evidence concerning hydrophobia.

But when the question occurs as to accepting the conclusion to which he has come, that no such specific disease, resulting in man from the bite of the rabid dog, has been proved to exist, Dr. H. H. must necessarily dissent from this, for the best possible reason, namely, direct personal observation.

It had happened to him, early in his practice, to meet with a case, the history of which was known to him from the beginning. The essential facts were these: a boy, eight years of age, was bitten, almost in front of the speaker's house, by a dog which, upon usual evidence, was considered to be mad. A day or two afterwards his father brought him to Dr. H. H., and, late as it was, excision of the bitten part was advised; this was, however, not consented to.

About a month afterwards Dr. H. H. was called to see him. Not proposing to detain the College with all the particulars of the case, which was fully reported in the *American Journal of the Medical Sciences*, it may be said that it was studied without any prepossession or expectation as to what its course would be. Dr. H. H. had not, before that time, become very familiar with the clinical history of the disease. The most striking symptom, which may be considered, in the speaker's present judgment, to be pathognomonic of hydrophobia in man, was an *excessive reflex excitability of the muscles of respiration.* This persisted throughout the case. Not only an effort to drink a fluid, but the sound of running water; any sudden sound; a flash of light; even the puff of air made by moving the hand lightly above the patient's face; every such slight cause would induce a *gasp* of respiration, which gave rise to incessant distress, and made swallowing food or drink impossible. The boy was violently delirious; and this, as well as his age, and the peculiar character of his affection, put quite out of sight any suggestion that a *mental* cause, from horrible anticipation of hydrophobia (such as, no doubt, in several other cases has existed) could influence the case. He died in about a week from the beginning of the attack.

Dr. H. H. also afterwards saw another case; that of a man, under the care of the late Dr. George W. Norris, in one of the surgical wards of the Pennsylvania Hospital. This patient was not delirious. In him, also, the reflex inspiratory spasm was clearly marked; although, for a time, he could swallow moistened pellets of bread, or other solids, but no liquids. Along with this, it must be noticed, there was *in neither case* any *tetanic muscular rigidity*. The absence of this at once differentiates such cases from tetanus: with which some authors, who have not *seen* instances of hydrophobia, have been inclined to conjecture their identity.

By such observations, confirmed by the records of many others in the literature of hydrophobia (which is not *all* confusion), Dr. H. H. has been obliged to conclude that there *is* a disease *sui generis*, to which that name, though not well chosen, may apply. Attacks do occur in men, after they have been bitten by dogs, which are unlike every other disease; therefore we infer the existence of a *specific* malady. It is, so far (with two or three *doubtful* exceptions only) invariably fatal. It may take place anywhere; even (as Dr. Dulles incidentally said) in Constantinople and Africa; notwithstanding the denial of this by some writers.

Against the horror and certain fatality of such a disease, granting its existence, the precautions now commonly taken are not at all excessive. It would be very unsafe for them to be relaxed, unless a clear case was made out of the actual non-existence of hydrophobia. It would be much to be regretted, therefore, that a conclusion, such as that of the paper just read, should go before the public, in the proceedings of the College, without protest—if, at all events, objection to it rested in other minds as well as in that of the speaker.

Dr. H. Hartshorne, after some further discussion, inquired of Dr. Dulles whether he rejected the opinion that *rabies canina* is inoculable from dog to dog?

Dr. R. P. Harris said: I have met with several cases of hydrophobia, and have been present when the disease was investigated by autopsy. I well remember the case of the boy just reported by Dr. Hartshorne. The youth and sex of the patient; the peculiar symptoms of his malady; and the history of his exposure to canine rabies, gave positive proof of the existence of hydrophobia. My father not having met with a typical case, in an extensive country

practice of twenty years, was inclined to doubt the existence of true rabies, until I took him to see this case. Dr. Hartshorne was present, and we examined the patient critically, and with much interest. This was the first case my father had had an opportunity to see, although he had then been in active practice more than thirty years, and it had the effect of convincing him that he had been in error in regard to it. The existence of this disease in young subjects, of which there are many cases on record, clearly proves to my mind that it is a veritable blood-poisoning, and entirely distinct from hysteria and the other neuroses. I have known a hysterical woman, under the fear of rabies, from having been bitten by a dog, manifest symptoms somewhat allied to those of hydrophobia; but a critical examination revealed the true nature of the disease. Such a case existed some years ago in Camden, and was very much talked about in Philadelphia; but the recovery of the lady satisfied the community of the true nature of the attack.

Dr. S. W. Gross asked Dr. Dulles if he desired to be understood as stating that hydrophobia was not a specific disease but a pure psychosis.

Dr. S. D. Gross inquired whether Dr. Dulles was willing to be bitten by a dog suffering from hydrophobia as a test of his belief in the non-existence of the specific disease in man.

Dr. Dulles declined at present to give an answer to the inquiry of Dr. Henry Hartshorne; because to do so would involve a discussion almost as long as that of the paper he had read. He preferred at this time to confine himself to the subject of hydrophobia as reported to occur in man.

In reply to the question of Dr. S. W. Gross, Dr. Dulles said that if the specific element in hydrophobia be eliminated—as he believed it ought to be—there remained nothing except to consider the cases as pure psychoses, or as errors of diagnosis. It is, he said, remarkable how little physicians seem to be aware of the number of conditions in which, as is well known to students of the subject, the symptoms of hydrophobia are simulated. In reply to Dr. S. D. Gross, he said, that the question the latter had asked, proposed not so much a test of the truth of his convictions,

as of his personal courage, and this was not the subject under discussion. But he could say that there had been a disbeliever in the specific theory of hydrophobia who had been willing to show his faith by his works. In the beginning of this century, Dr. White, a young surgeon, of Brighton, England, had allowed himself to be bitten by a mad dog, and had inoculated himself with this dog's saliva, without suffering any evil effects in consequence.

REPORT

OF THE

COMMITTEE ON METEOROLOGY AND EPIDEMICS FOR THE YEARS 1881 AND 1882.

By

JOSEPH G. RICHARDSON, M.D.,

PROFESSOR OF HYGIENE IN THE UNIVERSITY OF PENNSYLVANIA, AND MEMBER OF THE PHILADELPHIA BOARD OF HEALTH.

[Read December 5, 1883.]

METEOROLOGICAL observations for the year 1881 show that the winter months, as exhibited more in detail by the accompanying tables (see Tabular statement No. I.), were decidedly colder than the average, January being 5.7° below the mean for the past twenty-four years. The early part of spring was rather dry, but in June abundant rains occurred, and the average temperature was below the usual standard, although the entire summer average exceeded that of 1879 or 1880. The temperature of November was 4.5° above the mean, and but little ice or snow appeared during the following month. The most elevated temperature was observed on the 7th of September, when the thermometer rose to a height of 101½°. The lowest temperature was noted in February, when the thermometer fell to 1°; the entire range for the year being 100.5°. The mean relative humidity was 70.3, and the

total annual rainfall unusually scanty, only amounting to 30.21 inches.

The death-roll for 1881 comprised 19,515, or 22.48 per 1000, being an increase over the previous year of 1804 (see Tables II. and III.). Smallpox was by far the most prevalent among the epidemic disorders, causing death to 1336 persons (see Tables IV. and V.). Cholera infantum proved fatal to 902, scarlatina to 486, and diphtheria to 457 individuals (see Table VI.). Typhoid fever was much more prevalent than in any twelvemonth since the Centennial year, and caused 645 deaths, four hundred and fifty of these being among adults, and one hundred and ninety-five children (see Tables VII. and XIV.), for which as well as the other tabular statements I am indebted to the excellent Report of the Philadelphia Board of Health.

The early part of the year 1882 showed a rather low average temperature, the coldest weather in the two years now under consideration occurring in January, when the thermometer marked on one occasion half a degree below zero (see Tables VIII. and IX.). The summer months were rather below the mean temperature for that season, and the maximum attained at the U. S. Signal Office exceeded 90° on two days in June, and six days in July only. The rainy season set in early, six inches of rain falling in August, whilst in September the precipitation reached the extraordinary amount of 12.09 inches. The total annual rainfall was 45.58 inches, being more than one-half greater than that of 1881. Rain or snow fell on 118 days during the year.

The mean temperature for the entire year was 54.6°, with a range of 94.5°, extending from a minimum of

0.5° below zero in January to a maximum of 94° in June.

The total mortality for 1882 was 20,059, or 22.62 per 1000, being an increase over the previous year of 544 (see Table X.). Smallpox, although much diminished in frequency, continued to rage with alarming severity, proving fatal to 314 persons (see Tables XI., XII., and XIII.). Diphtheria was the gravest epidemic disorder, causing 933 deaths, whilst the epidemic spread of scarlatina was so far diminished that only 310 individuals fell victims to that disease. Cholera infantum levied almost its usual tribute upon the rising generation, cutting short 871 lives.

A gratifying feature in the mortality reports of 1882 is the increase by nearly 12 per cent. of the number of people dying from old age, which proved fatal to 824 individuals; of these 14 were recorded as being between one hundred and one hundred and ten, and one as being over a hunded and ten years old.

From the tables it appears that, although diphtheria has of late become increasingly and alarmingly prevalent in Philadelphia, our most serious epidemic disease during the past two years has been smallpox, and the obstinate continuance of this loathsome malady among us, as well as its gradual recrudescence from time to time, seems to call for renewed, and if possible improved measures towards its suppression.

The following suggestions having for their basis that principle of justice which prohibits men from even carelessly and unthinkingly injuring their neighbors, are submitted as a preliminary step to the establishment of some more efficacious plan of action, for preventing the spread of epidemics.

Our efforts in this direction can perhaps be aided by diligently teaching our patients, when opportunity serves, the doctrine of disease germs as held by most progressive physicians at the present day. Indeed the diffusion of popular knowledge upon this subject is I consider of immense importance from a sanitary, and especially from an epidemiological point of view, because as soon as the public is convinced that smallpox, diphtheria, typhoid fever, etc., are alone propagated by tangible and microscopically visible germs or seeds, which are carried from the sick to the well, isolation and disinfection will be regarded not merely as hitherto in the light of wise precautions, but as imperative duties for every conscientious and law-abiding citizen.

The knowledge we now possess of the germ theory of disease, lends a new and stronger emphasis to the eloquent statement of Prof. Aiken in regard to the original spread and terribly fatality of smallpox in America from a single negro sailor, landed on the Mexican coast. "No common conditions of human life," he remarks, "gave rise to such phenomena as these. Propagation from the actual poison of a pre-existing case was the one necessary and all sufficient cause for these endemic outbreaks of smallpox, and their epidemic prevalence. The precise mode in which the contagious diseases with their specific poisons first came into existence is beyond our ken—hidden from us as yet by a thick veil, and remaining an inscrutable, or at least so far an unpenetrated mystery. But everything tends to show that once created they all propagate only in one way—namely, by continuous succession."

An occasional failure to account for certain so-called idiopathic cases of contagious disease, is only what we have in the nature of things to expect, and forms no evidence against the truth of this assertion of Dr. Aiken. For whilst we cannot always trace the obscure route by which germs of contagious maladies reach the healthy from the sick, most medical men in active practice are doubtless able to recall circumstances which go far towards explaining the mystery of their conveyance. Thus for example about twelve years ago there presented himself to me in the Out-patient department of the Pennsylvania Hospital, a man covered with discrete smallpox pustules, who had been sitting muffled up and undetected, for more than an hour, in the waiting-room with twenty or thirty other patients, all unconscious of their danger of infection. In the epidemic of 1871–2 one of my patients whose nephew, a country lad here on a visit, was attacked with smallpox, dressed him up as a girl so that she could shroud him in a thick veil, and in spite of my remonstrances, took him by more or less crowded street car, ferry-boat, and railroad train, to his home in New Jersey, of course at the risk of numerous lives. Again during the same epidemic I attended two cases of variola in the family of a ready-made clothing dealer, whose coats and vests were probably all infected with the poison of smallpox, and went out of his shop on the backs of hundreds of customers, who were thereby subjected to the deadly peril of contracting that terrible disorder, without the slightest warning of their danger.

Admitting then that in some such modes as these, the germs of every American case of contagious dis-

case, occurring in the past two centuries at least, have emanated from some previous case, it is obvious that in a majority of instances, a knowledge of the chance for such conveyance of the poison, in time to prevent it, was possessed by the patient and his friends or nurses only. Hence in striving to obstruct the progress of an epidemic, our efforts will be most apt to win success, if we can devise some means powerful enough to control the ignorance and carelessness of each patient, and those of his immediate attendants, from the earliest possible moment of the attack.

Such a check against the negligent as well as the wilful dissemination of disease germs, may I believe be found in some modification of the admirable proposition of Dr. Albert L. Gihon, Medical Director U. S. N., before the American Public Health Association, in 1881, and I therefore earnestly recommend it to my fellow members of the College, for their individual consideration, perhaps at some future time for their official sanction and support.

Dr. Gihon, as Chairman of the Committee on the Prevention of Venereal Disease, presented a unanimous report, which contained the following section of a proposed act: Be it enacted that any person within the limits of this State who shall knowingly communicate, or be instrumental in communicating by any direct or indirect means, a contagious disease, such as smallpox, or scarlet fever, or venereal disease, shall be deemed guilty of a misdemeanor, and shall be subject upon conviction in any of the Circuit Courts of the counties of this State, or in the Criminal Court of the city of . . . . . to a punishment of six months' imprisonment in the . . . . of . . .

Now whilst I firmly believe in the strict justice and propriety of such a law as Dr. Gihon suggests, I fear that to urge it in its entirety at the present time in Philadelphia, would be making the grave mistake of trying to go too far beyond the present status of public opinion, and that even an attempt to punish the conveyance of the milder contagious diseases would not be sufficiently sustained by popular sentiment in our community.

But the horror of smallpox, which is often intense among populations in proportion to the density of their ignorance, would, it seems to me, so far aid physicians, and especially those of us who are members of the Board of Health, in an obviously judicious effort to obstruct the tide of its epidemic prevalence, that we might succeed in having passed and executed some law such as we have urged before our local legislators for two years, imposing a fine or imprisonment for the negligent or wilful transmission of that one disease, which would cause much greater care against the spreading of variola, to be exercised by those suffering from smallpox, or having charge of cases of that malady.

Our British cousins are far in advance of us in this respect, as is shown by the following extract from the *Sanitary Record*. "At Athenry Petty Sessions (in Ireland), a shopkeeper in that town named Dillon was fined £3 and costs, with the alternative of two months' imprisonment at hard labor, for having, to the danger of the public health, appeared in public at Galway, while in the convalescent stage of smallpox."

What parent among us would not far rather a desperate highwayman should steal his watch, than that

a smallpox patient in the condition of this Galway scoundrel, should simply brush against his unvaccinated child, and yet for the one crime the villain might be punished with years of imprisonment, whilst for the other as the laws now stand here no penalty whatever could be inflicted.

It perhaps would not frequently be necessary to institute legal proceedings against violators of a new law enacted to remedy this gross injustice, because as a rule, the mere fact that a person might be compelled to suffer in person or estate, for injuring a fellow citizen by infecting him with smallpox, would operate as a powerful check upon negligence, and could hardly fail to prove beneficial to us all.

As to the justice of punishing such instances of careless or wilful injury to life and health, it may be urged that murder by poison is just as much punishable by death, as is that by shot or steel, and that no valid distinction can be drawn between the moral guilt of one who kills his neighbor by giving him arsenic, and that of another who, under similar circumstances, causes the death of a fellow-being by giving him the germs (or poison whatever it may be) of smallpox. If either crime is committed intentionally it ought to be adjudged a murder, and if done knowingly though without malice, or even ignorantly and carelessly, the homicide is still, it seems to me, deserving of punishment.

A man who empties his revolver into a crowd of people, would be held answerable before our courts for the lives of any who might be killed by his shots, and why should a person who emptied out from his lungs, breath loaded with the germs of smallpox into

the same crowd, be judged guiltless of deaths he thereby caused? or why should it make any difference in the moral turpitude of the murderer's act, if a few of the crowd wore coats of mail in the first instance, or were protected by vaccination in the second?

The invisible messenger of death which is shot through the air in the former case, is not any more deadly to the stricken individual, than are the equally invisible germs of variola, as the graves of our 1300 citizens dead from smallpox in 1881 testify. It is infinitely *less* dangerous to the public, because the leaden bullet ends its malevolent work, with the human being it strikes down, whilst the vegetable missile may reproduce itself in its particular victim so as to originate a smallpox epidemic, and sacrifice in the community a hundred or a thousand lives.

The method for checking further dissemination of variola, which I have just advocated, is of course vastly inferior to that of establishing compulsory vaccination, yet I submit that whilst the latter plan infringes upon the personal rights of almost every one, the former curtails the liberties of a small minority only, and therefore under our republican form of government, is far more likely to secure a majority vote in its favor, whether in the halls of legislation, or in the community at large.

TABLE I.—METEOROLOGICAL OBSERVATIONS TAKEN AT THE SIGNAL OFFICE, PHILADELPHIA, PENNSYLVANIA.

Furnished by T. F. TOWNSEND, Signal Corps, U. S. A.

DATE, 1881.	BAROMETER. Mean of. Mean monthly.	Telegraphic observations. Corrected for temperature, instrumental error, and elevation. 7.07 A. M.	3.07 P. M.	11.07 Midn't.	Range. Highest.	Lowest.	THERMOMETER. Mean of. Mean monthly.	Telegraphic observations. 7.07 A. M.	3.07 P. M.	11.07 midnight.	Range. Minimum.	Maximum.	Mean relative humidity. Local observations. (per cent.)	WIND. Prevailing direction.	Total number of miles.	Maximum velocity during month.	Amount of rain or melted snow (inches and hundredths).	No. of days on which rain or snow fell.
January,	30.158	30.166	30.141	30.164	30.708	29.284	26.9	23.6	30.3	26.7	44.	4	77.1	W.	7.427	40	3 66	14
February,	30.192	30 211	30.164	30.200	30.825	29.381	30.3	29.3	35.5	29.1	61.	1	67.1	N.	8.052	39	4.76	11
March,	29.751	29.769	29.719	29.766	30.388	29.067	38.5	35.2	43.0	37.3	61.	22	72.5	N. W.	11,174	43	3.83	14
April,	29.896	29.917	29.852	29.918	30.403	29.647	48.5	44.0	55.6	45.9	82.	22	61.3	N. W	8,514	44	.61	10
May,	30.045	30.090	30.013	30.042	30.487	29.594	63.8	58.3	72.0	61.0	92.	42	71.3	E.	6,781	26	2.71	14
June,	29.920	29.941	29.896	29.924	30.208	29.664	67.1	63.6	72.5	65.1	89.5	51	70.2	E.	6 967	41	3.87	17
July,	29.954	29.973	29.929	29.961	30.270	29.640	75.5	71.0	82.1	73.5	94.	60	66.8	W.	6,973	29	.96	18
August,	30.037	30.070	30.040	30.037	30.351	29.644	75.0	69.5	83.3	72.2	99.	59	66.1	S. W.	5,343	32	1.18	8
September,	30.103	30.130	30.069	30.111	30.368	29.856	74.8	69.6	82.6	72.3	101.5	54	71.2	W.	5,845	24	.94	7
October,	30.163	30.199	30.126	30.162	30.612	29.531	60.8	56.2	67.3	58.8	87.	36	70.2	W.	7,031	31	3.04	10
November,	30.200	30.225	30.176	30.198	30.732	29.691	47.5	44.3	51.4	46.9	69.5	24	72.4	W.	5,879	38	2.02	16
December,	30.175	30 191	30.140	30.193	30.667	29.432	41.7	38.3	46.5	40.2	69.4	21.5	77.5	W.	4,887	34	2.63	16
Annual means	30.005	30.008	30.002	30.006	.....	.....	54.2	50.0	60.2	52.4	.....	....	70.3	.....	84,873	....	30.21	

TABLE II.—TOTAL WEEKLY DEATHS (STILL-BORN EXCLUDED), WITH METEOROLOGICAL OBSERVATIONS.

1881. Weeks ending	Total weekly deaths (still-born excluded).	Thermometer.			Barometer.	Rain.
		Mean.	Max.	Min.	Mean.	Inches.
January 8 . .	391	28.3	40	11	30.17	1.03
" 15 . .	366	27.0	44	9	30.06	2.00
" 22 . .	368	30.3	42	17	30.11	.63
" 29 . .	402	23.0	34	12	30.25	
February 5 . .	405	18.2	35	1	30.21	.65
" 12 . .	407	38.1	61	17	30.28	1.06
" 19 . .	411	32.4	47	21	30.23	1.92
" 26 . .	369	30.4	44	10	30.20	.30
March 5 . .	381	34.3	56	22	29.66	1.63
" 12 . .	401	39.8	56	35	29.82	1.57
" 19 . .	388	42.1	61	32	30.04	.76
" 26 . .	384	39.9	50	28	29.82	.06
April 2 . .	370	37.9	51	29	29.65	.76
" 9 . .	429	37.0	53	22	29.58	.01
" 16 . .	412	47.7	62	38	29.82	.35
" 23 . .	423	51.1	72	38	29.71	.06
" 30 . .	397	62.9	82	45	30.06	.08
May 7 . .	382	54.8	68	42	30.00	.52
" 14 . .	380	72.1	92	47	30.24	.10
" 21 . .	366	58.8	82	47	30.05	1.97
" 28 . .	317	66.2	84	55	29.85	.10
June 4 . .	302	69.2	89	52	30.11	1.86
" 11 . .	310	62.4	83	51	29.80	1.12
" 18 . .	276	69.2	86	55	29.95	.50
" 25 . .	318	67.9	86	53	29.97	.11
July 2 . .	320	74.1	89	61	29.95	.33
" 9 . .	442	77.2	93	62	29.93	
" 16 . .	477	77.7	94	64	29.98	.59
" 23 . .	475	74.9	88	60	30.02	.02
" 30 . .	446	73.3	89	64	29.76	.11
August 6 . .	398	78 9	96	66	30.02	.38
" 13 . .	450	76.0	99	63	30.08	.89
" 10 . .	400	68.5	80	59	29.88	.16
" 27 . .	349	73.6	89	62	29.88	.08
September 3 . .	375	71.5	93	62	30.12	.01
" 10 . .	419	78.2	101	65	30.07	.30
" 17 . .	345	70.0	83	60	30.10	
" 24 . .	340	72.8	88	54	30.17	.05
October 1 . .	404	78.1	92	68	30.08	
" 8 . .	347	62.9	81	37	30.15	.19
" 15 . .	339	57.5	74	36	30.23	.59
" 22 . .	341	61.6	85	46	30.27	.56
" 29 . .	341	57.3	69	40	30.19	.43
November 5 . .	324	56.3	70	35	29.99	1.81
" 12 . .	359	55.0	69	39	29.94	.94
" 19 . .	328	50.9	68	33	30.21	.09
" 26 . .	327	36.5	47	24	30.23	.64
December 3 . .	355	44.0	61	30	30.26	.41
" 10 . .	356	33.0	50	26	30.16	.14
" 17 . .	339	40.4	69	25	30.38	.51
" 24 . .	350	42.5	59	24	30.22	.51
" 31 . .	414	43.4	62	21	29.90	1.04

TABLE III.—MORTALITY IN EACH MONTH, FROM ALL CAUSES, DURING THE YEAR 1881.

1881. Months.	Males.	Females.	Boys.	Girls.	Under 1 year.	1 2	2 5	5 10	10 15	15 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 110	110 120	Adults.	Minors.	All ages.
						Ages.																	
January,	781	746	302	320	231	105	133	67	38	48	183	168	147	122	120	100	56	7	2	....	905	622	1,527
February	807	735	338	326	270	102	129	72	36	55	179	164	121	126	126	125	75	8	1	...	928	664	1,592
March,	985	938	414	379	357	123	142	77	38	56	220	205	176	154	162	126	80	8	....	....	1,131	793	1,924
Total,	2573	2470	1054	1025	858	330	404	216	112	159	582	537	447	402	408	351	211	23	3	....	2,964	2079	5,043
April,	834	827	373	335	305	101	143	66	33	60	197	149	137	128	131	132	63	12	3	1	953	708	1,661
May,	877	870	369	408	315	104	162	98	43	55	199	161	168	117	129	129	56	9	2	....	970	778	1,747
June,	626	598	296	290	270	50	117	67	39	34	117	121	103	84	97	65	48	3	....	....	638	586	1,224
Total,	2337	2295	1038	1033	890	264	422	231	115	149	513	431	408	329	357	326	167	25	5	1	2,561	2071	2,632
July,	964	876	606	544	774	132	115	69	27	33	138	127	105	102	84	75	48	11	....	....	690	1150	1,840
August,	1026	946	536	535	605	197	115	75	30	49	185	185	134	119	117	95	51	15	....	....	901	1071	1,972
Septemb.	746	762	353	390	372	144	92	62	25	48	164	149	129	90	107	75	38	12	1	....	765	743	1,508
Total,	2736	2584	1495	1464	1751	473	322	206	82	130	487	461	368	311	308	234	137	38	1	....	2,356	2964	5,320
October,	733	635	320	268	248	108	88	82	17	45	167	140	136	95	103	85	51	3	....	....	780	588	1,368
Novemb.	646	692	286	304	224	98	136	60	41	47	146	173	112	92	90	81	44	9	1	....	748	590	1,338
Decemb.	924	890	374	341	244	92	168	99	40	72	216	193	176	156	147	107	85	15	4	....	1,099	715	1,814
Total,	2303	2217	980	913	720	298	392	241	78	164	529	506	424	343	340	273	180	27	5	....	2,627	1893	4,520
Totals,	9949	9566	4567	4440	4219	1365	1540	894	387	602	2111	1935	1647	1385	1413	1195	695	112	14	1	10,508	9007	19,515

TABLE IV.—THE FOLLOWING TABLE WILL SHOW THE NUMBER OF SMALLPOX CASES AND DEATHS IN EACH WARD DURING THE YEAR 1881, TOGETHER WITH THE POPULATION, AREA IN SQUARE MILES, ETC.

WARDS.	Population (census of 1880).	Area in square miles.	Cases.	Deaths.	Ratio of deaths to cases.
First	43,085	5.509	676	155	1 in 4.3
Second	28,498	.442	167	44	1 " 3.8
Third	18,271	.191	127	30	1 " 4.2
Fourth	18,853	.229	193	43	1 " 4.5
Fifth	16,368	.321	170	33	1 " 5.1
Sixth	10,004	.321	41	5	1 " 8.2
Seventh	31,087	.439	173	28	1 " 6.1
Eighth	19,545	.435	72	16	1 " 4.5
Ninth	12,481	.400	38	8	1 " 4.7
Tenth	23,363	.359	54	11	1 " 4.9
Eleventh	12,930	.210	58	14	1 " 4.1
Twelfth	14,690	.193	40	2	1 " 20.0
Thirteenth	18,646	.259	76	4	1 " 19 0
Fourteenth	22,354	.300	86	11	1 " 7.8
Fifteenth	47,865	1.049	159	27	1 " 5.8
Sixteenth	17,802	.281	95	22	1 " 4.3
Seventeenth	20,451	.251	143	32	1 " 4.4
Eighteenth	29,354	.650	241	66	1 " 3.6
Nineteenth	43,887	.698	524	113	1 " 4 6
Twentieth	43,207	.734	191	46	1 " 4.1
Twenty-first	19,699	7.129	40	5	1 " 8.0
Twenty-second	31,798	18.114	29	2	1 " 14.5
Twenty-third	26,522	42.716	61	15	1 " 4.0
Twenty-fourth	46,057	9.725	134	27	1 " 4.9
Twenty-fifth	36,104	10.359	289	81	1 " 3.5
Twenty-sixth	35,138	7.481	308	72	1 " 4.2
Twenty-seventh	23,284	11.680	44	6	1 " 7.3
Twenty-eighth	34,442	6.343	302	[1]58	1 " 5.2
Twenty-ninth	40,787	1.400	284	55	1 " 5.1
Thirtieth	29,100	.519	97	22	1 " 4.4
Thirty-first	31,308	.....	199	51	1 " 3.9
Municipal Hospital	.....	.....	....	232	
Totals	846,980	129.450	5108	1336	

Ratio of deaths, 1 in 3.8.

[1] The statement of deaths in Twenty-eighth Ward does not include those occurring in the Municipal Hospital.

TABLE V.—THE FOLLOWING TABLE WILL SHOW THE NUMBER OF SMALLPOX CASES AND DEATHS IN EACH WEEK DURING THE YEAR 1881.

1881. Weeks ending	Number of cases.	Deaths.	1881. Weeks ending	Number of cases.	Deaths.
January 8 . .	271	55	July 2 . .	54	18
" 15 . .	192	40	" 9 . .	70	16
" 22 . .	236	47	" 16 . .	42	14
" 29 . .	186	54	" 23 . .	39	10
			" 30 . .	36	12
February 5 . .	189	61			
" 12 . .	166	49	August 6 . .	45	11
" 19 . .	162	49	" 13 . .	44	12
" 26 . .	194	44	" 20 . .	32	10
			" 27 . .	34	10
March 5 . .	132	49			
" 12 . .	168	45	September 3 . .	62	9
" 19 . .	125	37	" 10 . .	80	25
" 26 . .	150	43	" 17 . .	39	10
			" 24 . .	27	12
April 2 . .	123	41			
" 9 . .	129	36	October 1 . .	44	11
" 16 . .	126	37	" 8 . .	40	7
" 23 . .	148	33	" 15 . .	26	11
" 30 . .	132	42	" 22 . .	42	9
			" 29 . .	34	6
May 7 . .	146	35			
" 14 . .	134	35	November 5 . .	42	13
" 21 . .	149	23	" 12 . .	88	11
" 28 . .	94	29	" 19 . .	40	18
			" 26 . .	54	16
June 4 . .	105	27			
" 11 . .	118	29	December 3 . .	71	14
" 18 . .	64	20	" 10 . .	56	20
" 25 . .	119	15	" 17 . .	50	16
			" 24 . .	66	11
			" 31 . .	93	29
			Totals . .	5108	1336

TABLE VI.—THE FOLLOWING TABLE EXHIBITS A GENERAL SUMMARY OF DEATHS, MALE AND FEMALE, FROM SCARLET FEVER, FOR THE PAST TWENTY YEARS.

Years.	Totals	Jan.		Feb.		March.		April.		May.		June.		July.		August.		Sept.		Oct.		Nov.		Dec.	
		M.	F.	M.	F.	M	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1862 . . .	461	50	40	17	27	18	23	23	19	18	27	15	12	15	18	7	13	5	8	12	17	21	10	21	11
1863 . . .	275	11	6	12	21	20	19	22	25	17	13	17	8	10	12	7	7	7	8	6	3	7	9	6	2
1864 . . .	349	5	6	4	11	12	12	11	9	11	8	11	8	15	13	11	10	7	8	12	8	31	29	47	50
1865 . . .	624	34	38	43	52	37	41	25	35	13	21	35	35	27	19	23	19	11	12	10	6	25	23	18	22
1866 . . .	491	28	33	24	28	12	11	18	20	22	17	24	22	18	12	12	15	8	11	19	13	17	30	38	39
1867 . . .	367	38	41	22	27	17	18	16	19	22	27	11	18	8	22	12	8	2	1	9	6	7	7	6	3
1868 . . .	224	8	11	4	8	10	4	10	10	6	6	12	11	6	5	6	9	10	8	12	12	9	11	16	20
1869 . . .	799	22	21	29	23	37	35	33	36	34	40	47	37	28	33	18	34	15	25	32	23	46	43	62	49
1870 . . .	956	57	55	59	55	87	67	72	73	76	90	38	52	27	26	17	18	6	10	7	7	12	14	10	15
1871 . . .	262	19	14	15	22	22	22	15	15	20	17	5	12	11	2	7	3	1	4	7	6	5	9	5	4
1872 . . .	174	6	9	10	10	8	9	7	7	8	9	11	15	9	10	5	5	1	2	5	3	7	5	8	8
1873 . . .	319	17	13	13	22	30	18	18	20	25	19	13	11	16	4	2	1	5	6	3	11	11	15	11	9
1874 . . .	461	24	20	17	22	18	14	15	21	17	16	22	11	14	15	17	18	27	20	23	28	18	19	23	22
1875 . . .	1032	42	60	47	42	67	82	67	54	54	50	91	80	39	48	32	31	14	16	14	19	14	18	18	33
1876 . . .	328	39	25	20	15	37	29	20	18	15	23	12	8	14	3	4	2	1	4	7	10	9	6	10	6
1877 . . .	379	15	13	8	9	7	13	7	10	13	21	22	12	18	28	24	15	8	11	17	14	13	16	33	33
1878 . . .	554	32	27	24	26	32	23	26	22	30	32	22	19	17	20	16	9	15	17	35	28	19	22	22	19
1879 . . .	336	24	21	5	19	25	29	22	19	16	11	20	11	15	16	9	7	7	5	7	7	12	5	7	7
1880 . . .	291	5	12	10	18	5	6	7	10	17	26	12	16	3	8	9	18	6	5	4	12	19	13	23	27
1881 . . .	486	20	26	20	14	26	16	24	19	35	41	26	30	26	21	17	17	19	11	14	12	8	11	18	15

TABLE VII.—THE FOLLOWING TABLE SHOWS THE NUMBER OF DEATHS FROM TYPHOID FEVER IN EACH OF THE PAST TWENTY-ONE YEARS, FROM 1861 TO 1881, INCLUSIVE, IN EACH DIVISION OF AGE, WITH THE ADULTS, MINORS, AND TOTALS.

Years.	Ages.																Adults.	Minors.	Totals.
	Under 1 year.	1–2	2–5	5–10	10–15	15–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	110–120			
1861	1	4	23	25	8	37	88	30	36	14	10	5	..	..	..	..	183	98	281
1862	2	7	36	31	18	90	255	90	59	34	19	10	2	1	..	..	470	184	654
1863	1	7	27	33	27	50	147	87	44	30	19	11	3	..	..	..	341	145	486
1864	3	9	24	49	32	104	170	119	64	34	24	11	4	1	..	..	427	221	648
1865	10	7	33	38	35	82	210	120	96	75	49	13	5	..	..	..	568	205	773
1866	..	6	23	25	35	37	75	69	42	23	30	11	4	1	..	..	255	126	381
1867	4	7	18	25	19	38	88	47	39	33	32	11	5	1	..	..	256	111	367
1868	1	8	22	25	25	47	87	67	38	26	27	19	3	..	..	..	267	128	395
1869	3	5	15	28	32	40	119	44	27	24	21	10	5	..	..	..	250	123	373
1870	6	8	22	22	33	60	105	59	37	28	23	5	1	..	..	..	258	151	409
1871	2	3	18	24	25	32	97	42	27	19	14	7	2	1	..	..	209	104	313
1872	6	3	15	23	28	48	97	60	35	26	18	9	1	..	..	..	246	123	369
1873	..	6	11	21	26	52	109	54	33	19	14	16	..	..	..	..	245	119	364
1874	5	3	16	33	36	76	142	55	40	26	18	10	1	..	..	..	292	169	461
1875	7	2	20	38	20	58	120	51	33	35	20	10	5	..	..	..	274	145	419
1876	3	10	30	36	49	148	224	92	55	50	37	23	4	..	..	..	485	276	761
1877	..	5	22	40	39	96	142	72	43	41	23	17	2	..	..	..	310	202	542
1878	2	8	21	32	38	63	103	46	34	24	25	5	3	..	..	..	240	164	404
1879	3	5	20	21	24	26	103	47	36	27	19	10	2	1	..	..	245	99	314
1880	3	4	25	35	27	68	151	75	40	24	31	12	2	1	..	..	336	162	498
1881	4	9	20	35	43	84	217	122	42	32	22	11	4	..	..	..	450	195	645
Totals	66	126	464	639	619	1336	2849	1448	909	644	495	236	58	7	..	..	6637	3250	9889

TABLE VIII.—METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1882.

Latitude, 39° 57′. Longitude (east of Washington), 1° 51′. Magnetic variation, west 5° 30′, station Philadelphia, Pa.

1882. Month.	Mean Barometer. Washington time. 7 A. M. Local time. 7.07 A. M.	3 P. M. Local time. 3 P. M.	11 P. M. Local time. 11.07 P. M.	Mean.	Highest.	Lowest.	Mean Temperature. Washington time. 7 A. M. Local time. 7.07 A. M.	3 P. M. Local time. 3 P. M.	11 P. M. Local time. 11.07 P. M.	Mean.	Maximum.	Minimum.	Wind. Total—miles.	Max. hourly velocity—miles.	Rain or melted snow—inches.	Mean cloudiness in tenths. A. M.	P. M.	P. M.	Mean.
Jan.	30.141	30.086	30.120	30.116	30.781	29.328	28.8	34.1	30.8	31.2	51.5	0.5	7,362	42	4.57	5.6	6.2	5.9	5.9
Feb.	30.086	30.033	30.055	30.058	30.631	29.271	35.9	44.2	38.7	39.6	59	18	5,889	32	4.22	5.1	5.3	3.2	4.5
March.	30.029	29.970	30.031	30.010	30.595	29.485	40.6	48.5	42.7	43.9	66	24.5	6,851	30	3.57	6.3	5.8	4.0	5.4
April,	29.982	29.906	29.947	29.945	30.441	29.340	45.6	55.5	48.8	50.0	78	28.5	5,933	26	2.12	5.5	6.4	5.0	5.6
May,	29.951	29.906	29.925	29.927	30.362	29.406	53.4	63.0	55.5	57.3	82.5	40	5,719	24	5.06	6 6	5.7	5.7	6.0
June,	29.843	29.790	29.829	29.821	30.178	29.418	68.6	79.6	70.4	72.9	94	56	4,960	22	1.90	4.5	4.9	3.2	4.2
July,	29.950	29.905	29.942	29.932	30.232	29.518	73.4	83.6	75.3	77.4	93.5	57	3,926	20	1.37	4.4	7.2	3.7	5.1
Aug.	29.975	29.926	29.951	29.951	30.233	29.541	69.5	79.9	72.2	73.9	88	58	3,635	19	6.40	5.6	5.4	3.9	5.0
Sept.	29.986	29.940	29.971	29.966	30.198	29.517	65.3	74.1	67.9	69.1	87	49.5	5,571	28	12.09	5.0	5.6	4.8	5.1
Oct.	30.029	29.981	30.005	30.005	30.258	29.665	56.4	65.5	59.8	60.6	76.5	45	5,362	25	1.32	4.5	5.2	5.0	4.9
Nov.	30.096	30.050	30.085	30.077	30.480	29.577	40.9	47.7	42.7	43.8	73	27	4,984	24	.99	5.3	5.0	4.4	4.9
Dec.	30.053	30.003	30.037	30.031	30.381	29.549	33.1	38.6	35.9	35.9	54	14.5	5,831	29	1.97	5.3	6.0	5.7	5.7
Sums,	360.121	359.496	359.898	359.839	.....	.....	611.5	714.3	640.7	655.6	.....	.....	65,722	....	45.58	63.7	68.7	54.5	62.3
Means,	30.010	29.958	29.992	29.987	30.781	29.271	51	59.5	53.4	54.6	94	0.5	.....	....	.....	5.3	5.7	4.5	5.2

Table VIII.—Meteorological Summary—*continued.*

1882. Month.	Relative humidity (percentage of). A. M.	P. M.	P. M.	Mean.	Wind Directions. Number of times observed blowing from the— N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	No of calms.	Number of Days. Clear.	Fair.	Cloudy.	.01 in. or more rain or melted snow.	Max. temp. below 32°.	Min. temp. below 32°.	Max. temp. above 90°.	Remarks. Office moved to corner Tenth and Chestnut Sts., Philadelphia, Pa., on February 1, 1882.
Jan.	82.5	76.5	79.1	79.3	11	15	13	1	2	7	13	27	4	5	12	14	18	6	24	0	Lunar halo, 4, 30.
Feb.	76.8	61.6	73.8	70.7	10	7	7	4	7	17	12	20	0	12	9	7	11	1	12	0	Heavy snow-storm, 5; heavy thunder-storm. 21.
March,	70.4	52.9	67 5	63.6	10	8	6	8	8	11	13	29	0	7	14	10	10	0	7	0	Lunar halo, 7.
April,	66.8	49.6	65.2	60.5	10	13	8	6	7	11	11	24	0	6	15	9	10	0	2	0	Heavy thunder-storm, 2; lunar halo. 8, 25, 29: Aurora 16, 2[illegible]
May,	75.1	58.1	71.2	68.2	8	20	8	7	8	22	7	13	0	7	12	12	15	0	0	0	Lunar halo, 23, 24; thunder-storm, 28.
June,	69.3	46.0	65.3	60.2	5	5	3	1	20	23	16	16	1	10	18	2	5	0	0	2	Thunder-storm, 15, 18, 19, 25.
July,	69.6	46.6	69.6	61.9	1	8	1	10	7	30	17	18	1	10	14	7	7	0	0	6	Thunder-storm, 1, 12, 19.
Aug.	80.3	56.0	76.7	71.0	4	16	16	8	14	18	10	7	4	13	6	12	8	0	0	0	Thunder-storm, 8; heavy rain. 27 and 28.
Sept.	81.1	61.3	76.6	73.0	7	25	6	5	5	16	8	17	1	7	14	9	11	0	0	0	Very heavy rain, 22, 23: electric disturbance frequent, 23.
Oct.	82.2	62.2	78.6	74.3	10	37	1	1	0	21	4	14	5	10	13	8	9	0	0	0	Thunder-storm, 29.
Nov.	73.0	57.1	69.7	66.6	14	20	1	0	4	12	9	28	6	8	15	7	7	0	6	0	Electrical storm, 17, interrupted telegraph communication: aurora, 19, 20: first frost, 6; keen frost, 19.
Dec.	71.7	59.6	72.8	68.4	2	10	1	6	2	14	20	36	2	5	19	7	7	2	14	0	Lunar halo, 17.
Sums,	898.8	687.5	866.1	817.7	38	184	71	57	80	202	140	249	24	100	161	104	118	9	65	8	
Annu'l means	74.9	57.3	72.2	68.1	Percentages. 8	16.8	6.5	5.2	7.3	18.4	12.8	22.7	2.2	Percentages. 27.4	44.1	28.5	32.3	2.5	17.8	2.2	

Three daily telegraphic observations: 7 A. M., 3 P. M., and 11 P. M. (Washington time), only. Corrections for instrumental errors of barometer used: from 7 A. M. Jan. 1 to 11 P. M. Dec. 31, inclusive, +.008 inch. The barometric observations may be reduced to sea level by adding the following constants for the various months: Jan. +.110, Feb. +.110, Mar. +.100, Apr. +.100, May +.100, June +.100, July +.100, Aug. +.100, Sept. +.100, Oct. +.100, Nov. +.100, Dec. +.110.

TABLE IX.—MORTALITY IN EACH MONTH, FROM ALL CAUSES, DURING THE YEAR 1882.

1882 Months.	Males.	Females.	Boys.	Girls.	Ages. Under 1 year.	1 / 2	2 / 5	5 / 10	10 / 15	15 / 20	20 / 30	30 / 40	40 / 50	50 / 60	60 / 70	70 / 80	80 / 90	90 / 100	100 / 110	110 / 120	Adults.	Minors.	All ages.
Jan.	1,007	1036	432	439	337	138	206	94	44	52	229	191	181	165	165	141	77	18	2	..	1,172	871	2,043
Feb.	863	836	363	308	291	110	118	70	31	51	197	165	145	143	148	140	77	13	..	..	1,028	671	1,699
March	854	782	386	305	307	108	119	73	40	44	174	157	132	138	143	124	61	13	3	..	945	691	1,636
Total,	2,724	2654	1181	1052	935	356	443	237	115	147	600	513	461	446	456	405	215	44	5	..	3,145	2233	5,378
April,	823	803	357	327	277	105	141	70	32	59	212	169	125	129	124	116	50	15	2	..	942	684	1,626
May,	945	931	410	405	304	128	180	94	45	64	204	184	157	144	149	149	68	5	1	..	1,061	815	1,876
June,	711	644	320	280	248	93	133	59	26	41	144	132	105	116	99	93	54	12	..	..	755	600	1,355
Total,	2,479	2378	1087	1012	829	326	454	223	103	164	560	485	387	389	372	358	172	32	3	..	2,758	2099	4,857
July,	902	843	517	491	631	148	102	77	14	36	139	132	115	105	109	86	44	5	2	..	737	1008	1,745
Aug.	1,058	1055	593	541	672	190	121	71	35	45	179	158	129	122	164	149	65	13	..	..	979	1134	2,113
Sept.	716	673	365	314	326	116	109	76	19	33	134	133	92	115	93	78	47	16	2	..	710	679	1,389
Total,	2,676	2571	1475	1346	1629	454	332	224	68	114	452	423	336	342	366	313	156	34	4	..	2,426	2821	5,247
Oct.	814	809	350	332	260	109	152	97	13	41	193	161	132	141	123	111	65	14	1	..	941	682	1,623
Nov.	712	664	340	263	214	77	141	105	26	40	154	122	133	113	108	86	48	7	1	1	773	603	1,376
Dec.	798	780	368	347	282	93	168	97	37	38	151	150	131	120	119	121	62	7	1	1	863	715	1,578
Total,	2,324	2253	1058	942	756	279	461	299	86	119	498	433	376	374	350	318	175	28	3	2	2,577	2000	4,577
Totals	10,203	9856	4801	4352	4149	1415	1690	983	372	544	2110	1854	1580	1551	1544	1394	718	138	15	2	10,906	9153	20,059

TABLE X.—MONTHLY RETURN OF SMALLPOX CASES IN EACH WARD DURING THE YEAR 1882.

WARDS.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug	Sept.	Oct.	Nov	Dec.	Total.
First	29	22	14	14	18	23	15	8	20	34	26	45	268
Second	3	5	6	5	7	5	..	1	..	2	1	4	39
Third	2	2	1	1	2	..	3	..	1	1	..	..	13
Fourth	7	7	2	7	2	..	..	..	..	..	..	4	29
Fifth	6	4	3	3	4	4	3	..	1	..	4	2	34
Sixth	6	7	3	..	..	1	..	..	..	..	..	..	17
Seventh	12	10	8	6	3	1	1	..	..	..	4	5	50
Eighth	4	3	2	..	..	..	..	..	..	..	..	1	10
Ninth	..	1	..	..	..	..	..	..	..	..	..	..	1
Tenth	13	5	5	..	..	1	..	1	..	..	..	1	26
Eleventh	6	4	3	4	1	..	..	..	..	..	..	1	19
Twelfth	3	3	6	3	4	2	..	..	..	..	..	..	21
Thirteenth	4	6	1	2	..	..	..	..	..	..	..	2	15
Fourteenth	7	10	2	4	..	1	..	..	..	..	..	1	25
Fifteenth	9	5	4	1	5	1	..	..	1	..	1	3	30
Sixteenth	10	5	4	3	1	..	..	..	.	..	..	1	24
Seventeenth	13	4	6	1	1	1	1	..	..	..	..	1	28
Eighteenth	10	7	5	7	..	..	..	..	..	..	..	1	30
Nineteenth	38	46	28	16	11	3	6	2	..	..	..	11	161
Twentieth	11	23	13	4	6	..	..	..	..	..	..	4	61
Twenty-first	5	6	5	2	7	3	1	..	..	..	..	..	29
Twenty-second	4	2	1	4	..	..	..	..	..	..	..	1	12
Twenty-third	3	10	5	..	..	..	..	..	..	..	1	3	22
Twenty-fourth	19	13	8	13	5	2	..	..	..	2	5	4	71
Twenty-fifth	19	13	5	6	5	2	1	5	2	..	..	7	65
Twenty-sixth	11	9	12	10	5	5	..	..	2	4	..	7	65
Twenty-seventh	..	3	9	6	2	2	..	..	..	..	..	..	22
Twenty-eighth	20	27	17	12	6	..	2	..	..	..	3	9	96
Twenty-ninth	42	12	6	6	4	2	..	..	2	..	2	4	80
Thirtieth	2	4	3	4	4	3	..	..	..	..	..	3	23
Thirty-first	3	6	11	6	3	2	3	1	1	..	..	2	38
Totals	321	284	198	150	106	64	36	18	30	43	47	127	1424

TABLE XI.—THE FOLLOWING TABLE WILL SHOW THE NUMBER OF SMALLPOX CASES AND DEATHS IN EACH WARD DURING THE YEAR 1882, TOGETHER WITH THE POPULATION, AREA IN SQUARE MILES, ETC.

WARDS.	Population (census of 1880).	Area in square miles.	Cases.	Deaths.	Ratio of deaths to cases.
First	43,085	5.509	268	61	1 in 4.4
Second	28,498	.442	39	4	1 " 9.7
Third	18,271	.191	13	4	1 " 3.2
Fourth	18,853	.229	29	4	1 " 7.2
Fifth	16,368	.321	34	5	1 " 6.8
Sixth	10,004	.321	17	4	1 " 4.2
Seventh	31,087	.439	50	6	1 " 8.3
Eighth	19,545	.435	10	1	1 " 10.0
Ninth	12,481	.400	1	..	.0
Tenth	23,363	.359	26	2	1 " 13.0
Eleventh	12,930	.210	19	1	1 " 19.0
Twelfth	14,690	.193	21	1	1 " 21.0
Thirteenth	18,646	.259	15	2	1 " 7.5
Fourteenth	22,354	.300	25	5	1 " 5.0
Fifteenth	47,865	1.049	30	4	1 " 7.5
Sixteenth	17,802	.281	24	9	1 " 2.6
Seventeenth	20,451	.251	28	8	1 " 2.5
Eighteenth	29,354	.650	30	9	1 " 3.3
Nineteenth	43,887	.698	161	27	1 " 6.0
Twentieth	43,207	.734	61	9	1 " 6.7
Twenty-first	19,699	7.129	29	3	1 " 9.6
Twenty-second	31,798	18.114	12	1	1 " 12.0
Twenty-third	26,522	42.716	22	4	1 " 5.5
Twenty-fourth	46,057	9.725	71	12	1 " 6.0
Twenty-fifth	36,104	10.359	65	13	1 " 5.0
Twenty-sixth	35,138	7.481	65	16	1 " 4.0
Twenty-seventh	23,284	11.680	22	3	1 " 7.3
Twenty-eighth	34,442	6.343	96	[1]18	1 " 5.3
Twenty-ninth	40,787	1.400	80	13	1 " 6.1
Thirtieth	29,100	.519	23	2	1 " 11.5
Thirty-first	31,308	.....	38	9	1 " 4.2
Municipal Hospital	.....	.....	..	54	
Total	846,980	129.450	1424	314	1 in 4.5

Ratio of deaths, 1 in 4.5.

[1] The statement of deaths in Twenty-eighth Ward does not include those occurring in the Municipal Hospital.

TABLE XII.—DEATHS IN EACH YEAR FROM SMALLPOX FROM 1807 TO 1882, INCLUSIVE, WITH THE AVERAGE POPULATION OF EACH YEAR, AND DEATHS TO EVERY 1000 PERSONS LIVING.

Years.		Deaths.	Deaths to 1000 living persons.	Years.		Deaths.	Deaths to 1000 living persons.
1807	Population, 111,210	32	.28	1846	Population, 408,762	251	.61
1808		145	1.28	1847		9	.02
1809		101	.90	1848		100	.24
1810		34	.30	1849		152	.37
1811		117	1.04	1850		40	.09
1812		...	....	1851		216	.52
1813		...	....	1852		427	1.04
1814		...	....	1853		57	.13
1815		...	....	1854		40	.09
				1855		275	.67
1816	Population, 137,097	97	.77				
1817		52	.30	1856	Population, 565,529	390	.68
1818		8	.05	1857		65	.11
1819		1	....	1858		7	.01
1820		...	....	1859		2	.003
1821		...	....	1860		57	.10
1822		...	....	1861		758	1.34
1823		160	1.16	1862		264	.46
1824		325	2.37	1863		171	.30
1825		6	.04	1864		260	.45
				1865		524	.92
1826	Population, 188,797	3	.01				
1827		100	.52	1866	Population, 674,022	144	.21
1828		107	.56	1867		48	.07
1829		81	.42	1868		48	.07
1830		86	.45	1869		6	.008
1831		14	.07	1870		9	.01
1832		37	.19	1871		1879	2.78
1833		156	.82	1872		2585	3.83
1834		195	1.03	1873		39	.05
1835		101	.53	1874		15	.02
				1875		54	.08
1836	Population, 268,034	76	.33				
1837		79	.34	1876	Population, 846,980	407	.45
1838		42	.16	1877		155	.17
1839		5	.01	1878		...	...
1840		63	.24	1879		6	.006
1841		259	1.00	1880		424	.05
1842		156	.60	1881		1336	1.57
1843		36	.13	1882		314	.03
1844		17	.06				
1845		190	.73				

TABLE XIII.—THE FOLLOWING TABLE EXHIBITS A GENERAL SUMMARY OF DEATHS, MALE AND FEMALE, FROM TYPHOID FEVER, FOR THE PAST TWENTY-ONE YEARS.

Years.	Totals.	Jan.		Feb.		March.		April.		May.		June.		July.		Aug.		Sept.		Oct.		Nov.		Dec.	
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1862	629	23	12	24	12	22	13	22	8	23	10	25	14	68	16	109	17	34	14	44	18	37	16	36	12
1863	485	28	8	22	10	32	13	37	17	11	12	13	7	37	10	28	9	30	12	24	16	29	11	49	20
1864	648	27	18	28	12	36	21	26	16	25	19	20	18	35	14	69	27	38	18	40	25	25	23	39	29
1865	773	37	39	37	32	51	40	47	36	30	29	37	31	32	23	43	35	32	27	17	26	32	21	20	19
1866	381	20	14	16	13	14	18	8	14	7	8	9	12	14	8	34	24	21	21	27	25	16	13	16	9
1867	367	19	16	8	7	11	15	22	10	17	17	15	9	19	18	13	17	23	23	18	21	9	13	12	15
1868	395	14	17	10	13	15	16	13	14	7	13	19	12	15	26	22	21	23	23	11	16	15	23	20	17
1869	373	20	12	11	9	18	18	9	12	23	18	12	16	11	18	23	24	19	9	21	15	13	10	13	19
1870	409	13	10	12	15	33	21	16	8	26	21	22	17	21	18	27	27	18	19	10	6	7	11	13	8
1871	313	17	16	8	7	11	14	19	5	18	14	12	9	9	11	15	16	13	16	19	9	13	14	14	14
1872	369	14	12	15	10	19	13	11	12	11	36	13	11	20	20	21	16	20	18	20	14	17	6	20	10
1873	364	17	17	7	4	24	13	11	5	17	11	16	13	20	12	18	12	12	18	23	17	21	13	24	19
1874	461	24	20	17	22	18	14	15	21	17	16	22	11	14	15	17	18	27	20	23	28	18	19	23	22
1875	420	19	18	16	14	21	20	13	8	13	15	14	19	10	15	24	27	21	17	15	21	19	11	27	26
1876	761	21	15	16	21	22	23	26	9	25	26	24	20	25	25	67	42	47	57	45	43	29	32	45	56
1877	542	45	29	12	12	10	14	15	19	20	19	20	21	38	22	33	25	25	34	26	29	12	16	21	25
1878	404	15	19	12	20	12	16	16	19	15	14	14	12	11	12	38	20	19	20	21	20	12	14	13	20
1879	344	17	23	13	12	18	14	13	12	15	12	10	12	14	10	20	10	12	16	17	14	14	17	19	10
1880	498	22	17	14	15	17	21	13	14	18	16	12	9	22	18	35	45	21	10	23	15	29	20	44	28
1881	645	16	16	13	17	20	17	27	20	20	18	10	7	21	17	56	34	43	35	53	33	38	47	46	21
1882	650	35	25	36	20	31	24	47	32	43	33	35	22	17	11	29	23	25	24	24	28	19	14	31	22

CHRONIC NASAL CATARRH IN CHILDREN.

By

HARRISON ALLEN, M.D.,

PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

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In many instances the clinical history of a case of chronic nasal catarrh in the adult embraces groups of symptoms which belong to the period of childhood. Comparisons of numbers of such histories force the observer to the conclusion that the juvenile phase of the disease includes various conditions of the nasal chambers, and of the pharynx. A lady, aged thirty, reporting for the treatment of a catarrh which had persisted from the seventh year, recalled the distress at that time experienced from the frequent passage of mucus from the naso-pharynx to the oro-pharynx. A young man, aged twenty, who suffered from obstruction of the nasal chambers, and whose tonsils were normal at the time of examination, remembered the fact that these bodies were of large size when he was quite young. A third patient, aged thirty-five, suffering from copious muco-purulent discharge from the nose, complicated with pharyngitis, was confident that the habit of hacking had annoyed him as early as his ninth year to as great a degree as at the date of reporting for relief. While it must be conceded

that in recording the clinical history of an adult, allowance must be made for lapses of memory and for the probable coexistence of exanthematous and of diphtheritic sore-throats, it is certain that some of the little patients who come under care exhibit symptoms which are apt to persist in some modified form in adult life.

In the light of such evidence it becomes a matter of interest to ascertain what peculiarities, if any, are to be found which characterize chronic nasal catarrh in children.

Accepting as an axiom that this disease cannot be appropriately studied without a correct understanding of the structures of the nasal chambers, it must follow that the differences between the adult and other juvenile phases of the disease may be expressed in some degree by the differences between the peculiarities of the chambers themselves at the two periods.

In the child the vestibule is small, the floor is raised, the inferior meatus is shallow, the mucous membrane is of a delicate red color, and the eminences corresponding to the anterior ends of the inferior turbinated bones are rounded, and relatively of greater length than in the adult.

In part owing to the difficulties attending examinations, and in part to inherent distinctions, the juvenile aspect of the disease is marked by a number of negative features. Thus, the membranes are never infiltrated with the products of inflammation, or corrugated, or ulcerated. The lower border of the inferior turbinated bone is never concealed within a deep inferior meatus. The septum is never, or almost never, deflected, unless a history of injury explains

such deflection. Disease is never located above the respiratory tract. Atrophic catarrh is unknown.

Symptomatology and Diagnosis.—Congestion and acute inflammation of the nasal mucous membrane is common in childhood. The discharge in the beginning of the attack is almost always mucoid. The serous stage so commonly present after profound impression in adults, is not recognizable, and the transition is usually abrupt between a discharge of mucus to one of muco-pus. If air passes freely through the chambers the discharge is apt to dry and to form "crusts" or "scabs." These collect for the most part in the vestibule, though they may form at any portion of the respiratory tract. The discharge will often remain muco-purulent throughout the entire treatment, so that instead of expecting a return of the mucoid stage the practitioner should look forward to a gradual cessation of the amount of the discharge. The muco-pus in favorable cases becomes thicker as the case improves, and toward the close is often of the consistence of curd.

The child either "sniffles" in order to draw into the nose the discharge which, from the shallowness of the vestibule, inclines to flow outward from the nostrils, or it exhales or "hawks" if it inclines to fall into the pharynx. By careful observation of these acts it can be ascertained that the place at which the discharge is most annoying (all things remaining the same), is also the place at which the greatest amount of obstruction exists.

Should the tonsils be very large and establish mouth breathing, care should be taken not to confound the tumid state of the membranes of the nasal

chamber with the evidences of local disease. Although the two conditions of nasal catarrh and enlargement of the tonsils often exist together, they need not.

When tumid tonsils are present the probabilities are in favor of the adenoid growths at the roof of the pharynx being in the same condition. The naso-pharynx in such patients is occupied with tenacious mucoid discharge. The nasal chambers and the naso-pharynx considered as parts of a single chamber are shut off from communication with the oro-pharynx and the normal downward flow of mucus prevented. The mucus can be at times brought away through the nose by the handkerchief, and the impression may be erroneously received that the discharge, instead of being pharyngeal and mechanically retained, is catarrhal, and that it originates in the nose.

It need be scarcely necessary to say that the presence of mucus in a naso-pharynx which is thus narrowed, the danger to aural complication is decided, and, while the condition is one not admitting of classification with cases of true nasal catarrh, the diseases of the nose and ear are inextricably associated.

The general health is rarely good, and symptoms which relate to mal-nutrition are so pronounced that they have received careful attention at the hands of the writers on diseases of children. This subject is elaborated in the succeeding paragraphs.

Etiology.—Chronic catarrhal states in childhood are invariably associated with other effects of mal-nutrition. While this is not a novel statement, it is at

least one which has been imperfectly formulated. Such effects should not be dismissed as being simply those of scrofula and of rickets, but should be exactly referred, as far as it is possible so to do, to the laws of development. Many conditions are present in patients who suffer from catarrh, which may be called errors in development. It is true, these errors are not of the kind denominated "variation" or "anomaly" but are pathological, and may be regarded as the results of precocity or retardation occurring in rapidly growing tissues. They are conspicuous in bone-tissue, tooth-tissues, skin-tissues, lymphatic tissue, and in nerve-tissue.

From the earliest period in development to its completion at the twenty-first year, disease will modify structural processes much more readily and profoundly than at any subsequent period. The tissues may be said to be more plastic during the formative period and to retain the impress of morbid action a longer time than in the adult, and to carry into the future the results of this impress in altered relation or proportion of the formed elements. It is not intended in this place to show that chronic nasal catarrh is in any respect peculiar in this regard, but to invite attention to the operation of such forces which appear to have escaped detection.

The period of childhood is marked by changes as great in the proportions of the parts of the head and face as in any other parts of the body. The growth of the brain and the development of the permanent teeth are among the more striking of these. Clinical writers lay great stress upon the influence exerted on the economy, by the errors of cerebral and dental

growths. Are the influences they exert in the etiology or in the maintenance of nasal catarrh to be ignored?

The condition of the development of the brain in connection with those of the nasal chambers while one of great interest presents difficulties for the investigator, since the examination of large numbers of examples would be required before conclusions worthy of credence could be reached. Ophthalmologists have indeed noted that the accelerated rates of development of the brain exist with a disposition to myopia. If such be the case, it is rational to conclude that the shapes of the nasal chambers will be in correlation with the states of the olfactory nerves, and thus the influence which exists between the brain and the eye will be found also to exist between the brain and the nose. The extent to which chronic nasal catarrh may be found among myopes cannot be formulated.

There is no doubt that the patients are as a rule in an unnatural mental condition. The mind is either over-active or dull; the temper is irritable and the disposition intractable; digestion is delicate, and reflex disturbances arising therefrom are of frequent occurrence. The patients belong to the class of subjects that develop morbid appetites, and, in girls, yield the predisposing causes which create so much disturbance at the approach of puberty. Chorea is occasionally noticed as a complication. In one example, a child of precocious intelligence, of delicate constitution, and who had nearly perished during an attack of acute pleurisy, the habit of exhaling air from the nostril was acquired after all symptoms of catarrh had ceased.

The fact that with chronic nasal catarrh, errors of

development of the teeth and rates of growth and nutrition of the nails are often associated, it is convenient to examine together the relations between the nails, the teeth, and other structures. By way of introduction to this topic, it can be said that in pathology the connection between the hair, the nails, and the teeth are numerous.[1] Abnormal development of the teeth occurs in congenital hypertrichosis. Hair and teeth are commonly found in dermoid cysts. In man and in ruminants hairy warts are found upon the cornea. In congenital syphilis, the cornea, the teeth, and the nails are all liable to peculiar inflammatory invasions. Is it not more than a surmise that since all these structures—the hair, nails, enamel-organs, and cornea—arise from the *epiblast*, and are strictly tegumental in nature, that they may be found affected together? Be this as it may, the nails and teeth are certainly to be con-

[1] From the fact that the writer's biological and clinical studies have been pursued conjointly, he trusts that it may be warrantable to introduce at this place some reflections concerning the nails and the teeth. These structures are of correlative value in mammals generally. Blunt, flat teeth are always associated with hoofed digits, and sharp, conical teeth with clawed digits. Adopting the methods of the evolutionist, it may be assumed that the same forces which have been operative in changing the forms of teeth are also operative in changing the forms of the hoofs and claws. This correlation is not found in the earliest of the mammalia. In the process of evolution of the quadrupeds, as they exist about us, from the few generalized types known to have flourished in the past, it can be inferred that the impress upon the nutritive processes which could affect the forms of the teeth could also impress the entire tegumental series of the organism; not only the teeth and the nails would be in common affected by common causes, but the hair as well. Confining these remarks, however, to the nails and teeth, it is probable that the changes of food-supply necessitating corresponding changes in habit would most probably affect the claws and hoofs sooner than the teeth, since the latter are more resisting, and, at least in many genera, are completely formed, while the claws and hoofs are of continuous growth, and would be more readily influenced by changes in the environment.

sidered together in studying chronic nasal catarrh in children, the nails at all times and the teeth during the formative period of the enamel-organs.[1]

Through the courtesy of Dr. J. Wilks O'Neill, the attending physician to the Southern Home for Destitute Children, I have recently examined 96 children, with the object in view of determining to what degree a connection could be traced between the teeth and the nails in individuals, many of whom, if not all, were known to have been subjected to neglect and to the various inherited effects which could reasonably be accepted as tending to retard development.

Of the entire 96 children, 15 had white spots on the finger-nails in abundance; 5 of these had noticeably defective dental development — that is to say, excessively chalky enamel—distorted and disfigured crowns, etc. 3 had moderately chalky crowns, but no distortion. 7 had no appreciable defect.

No defective teeth were found in the remaining 81 children, so that the existence of dental defect exactly correlated with the spotted finger-nails. Of the 15 children thus selected, a little less than half the entire number had spotted nails but no dental defect. No attempt was made to ascertain any defect of rate of eruption, for the data obtained from the inmates of an asylum for destitute children would be unreliable. It is quite likely that the numbers of defects of teeth would be increased rather than diminished by more careful examinations made by dentists or other per-

[1] Among the applications of the rate of the growth of nails in connection with diseased states, reference may be made to papers by Dr. S. Weir Mitchell on paralysis, Dr. J. M. DaCosta on typhoid fever, C. E. Hasse on cyanosis, and Poland and Langenbeck on aneurism.

sons accustomed to detect minute abnormalities. Concerning the defective teeth and nails, it is conceded that they may have arisen from acute illness, as in the exanthemata, or from gingival inflammation, as in congenital syphilis. The "measles-tooth" was found but in a single individual, whose case was not enumerated. For the rest it is quite possible some of the appearances may have been due to syphilis, though the pegged tooth was found in a single instance only. No account was taken of the occurrence of catarrh in the inmates, for although it is probable the condition existed it was not reported as present by the attendants. The disease is rarely recognized among the children of the poor, where the symptoms are not likely to receive attention.

From a careful study of nine patients from the writer's practice, it was found that five exhibited white spots on the nails of the hand and defects in the form and irregularity of rates of eruption of the teeth. In a young lady, aged fifteen, who came under care for this phase of catarrh, the superior lateral incisors had never been erupted, while the left deciduous superior canine tooth had remained in the arch. In a second case of a girl, fifteen years of age, who had been much neglected, the depression remaining upon the vertex (answering to the anterior fontanelle) was conspicuous, the teeth were irregular, the vault of the hard palate high and narrow, the disposition shrinking and irritable, and the mental faculties dull. In such patients the epiphyses of the bones will be seen to be too large for the shafts, particularly in the case of the radius as it enters into the composition of the wrist-joint. At the same time the finger-nails

are often marked by large white spots, and the teeth, with milky opacities of the enamel.

The bones being slow in growth, the function of manufacture of blood-corpuscles is largely withheld from the medulla and retained for a longer period than is natural in the bloodvessel-glands, notably the thyroid body, the tonsils, and the lymphatic glands. Hence a disposition exists for these structures to undergo hypertrophy. If this method of reasoning be accepted it is evident that the presence of enlarged tonsils need not be regarded as a primary cause of the condition above outlined, though doubtless they may aid in a secondary manner in maintaining morbid determination of blood about the head, and, if they are sufficiently bulky to cause obstruction in respiration while the mouth is closed, will in themselves create a class of disturbances peculiarly their own. All that is to be emphasized in this connection is the fact that the causes of tonsil-enlargement are due to nutritive conditions which are part of the history of the lime-selecting and the blood-making tissues everywhere in the body.

Frequency and Diagnosis.—From a somewhat extended experience in the treatment of these and allied disorders, the writer has concluded that chronic nasal catarrh in the child is a rare disease, and must be separated from the catarrhs which are so common with the children in this community. A child, otherwise healthy, who contracts a severe cold, may have a duration of the nasal discharge for a time, which excites the apprehension of the parents, and the advice of the physician is asked. If no other sign exists but the discharge, that is to say, if the char-

acters already enumerated are absent, the case can be diagnosticated *subacute nasal catarrh.* If, however, in connection with the discharge, distinct evidences of malnutrition exist—as instanced in the skeleton, in the tonsils, nails, and teeth—the diagnosis of *chronic nasal catarrh* can be made.

Congenital Malformation.—While causes operating upon the fœtus may be said to create the conditions which have just been recognized, it is also true that an entirely distinct class of pre-natal influences is effective in creating nasal catarrh. In a case of absolute atresia of both nasal chambers—with which condition was associated defective speech—the effect to the ear of the listener was almost identical with that produced in cases of cleft palate, notwithstanding the fact that the palatal and the pharyngeal mechanism were apparently normal. In another case, that of a child three years of age, it was noticed that after an attack of scarlet fever the child could no longer breathe through the nose. The parents were inclined to attribute this condition to changes brought on in the nose by the attack of illness. Inasmuch, however, as the left side was absolutely occluded and the right side merely permitted a cotton-tipped probe to pass through into the pharynx; and, in addition, the fact that the hard palate was narrowed and very high arched, while lachrymal obstruction and fistules existed on both sides, being more on the left, the conclusion was drawn that the condition was congenital, and was due to errors in the formation of the bones of the face. In this case the angles of the mouth were excoriated, the cervical lymphatic glands were enlarged, and the

existence of congential syphilis established, although the teeth were not pegged nor the cornea hazy.

Effects of Local Injury.—The extent to which local injury influences the shape of the nasal chamber has a special bearing upon the subject of nasal catarrh in children. As a result of the frequent falls upon the face, it has been assumed that the deflection of the nasal septum which is so common in the adult, may arise from this cause. While it is conceded that blows on the nose may deflect the septum and thus induce obstruction and nasal distress, it is in the experience of the writer a rare occurrence. He has met with four cases only of such a condition, and in one of these a marked hereditary condition existed to nasal catarrh.

Prognosis.—The prognosis of simple cases of acute, and of subacute nasal catarrh in children is always favorable. The prognosis of the chronic cases should be guarded. Success depends to such an extent upon the recuperative power of the constitution of the patient, and to the character of the surroundings, that it is difficult to fix upon any one issue in all cases. It has already been seen that if neglected, the disease may be as noticeable in adult life as in childhood. Assuming the premises as to the nature of chronic nasal catarrh to be correct, it is evident that a cure cannot be expected until the development of the larger medullary cavities of the bones is completed. Under appropriate treatment the disease is so far kept under control, that all suffering abates and disappears, at the same time that the general system remains in an unsatisfactory state. Of such cases a reasonable hope may be held out that the disease will be entirely cured by the twenty-first year.

Treatment.—The details of the treatment may be embraced under the following heads:—

(1) Removal of the obstruction of the discharges and the reduction in size of the swollen membranes.
(2) The applications of mercurial ointment to the vestibule.
(3) Straightening the nasal septum and overcoming atresia.
(4) The administration of general tonics, etc.

(1) The removal of the daily accumulation of the discharge in the nose and the naso-pharynx is a matter of great moment. If the discharge is in the nose it may be removed by dropping into the nose by a pipette (the head being thrown back) a few drops of a detergent lotion. In a short time the fluid is felt in the throat. It is very gratifying to notice the prompt relief which follows the judicious use of such remedies to the nasal mucous membrane, particularly if the medicine be allowed to trickle in small quantities along the lower border of the inferior turbinated bone.

When a mucoid discharge collects in the naso-pharynx, it is best removed by the use of the pharyngeal syringe. The instrument used should be smaller than the one sold under this name. An instrument of convenient form can be improvised by attaching an Eustachian catheter to the nozzle of a No. 1 India rubber syringe, or to the smaller syringe used by dentists. The rule should be subject to no exception that the liquid is to be placed above the palate with the greatest care and gentleness, and a very small quantity, not over twenty to thirty drops of the liquid, thrown in.

After the instrument has been withdrawn, the head is bowed and the fluid is invited to flow through the nose and to trickle from the nostrils. A child who has had the instrument used with violence, will never consent to a second insertion. It must be remembered that the naso-pharynx in the child is very small, and becomes reduced to a mere chink when constricted, as at the time of the introduction of the nozzle of the syringe. The fluid thrown in cannot return into the oro-pharynx, but must flow forward. Should force be used by sending into the chamber a larger quantity of liquid than it can retain, and obstruction be present in the nasal chambers, the fluid will be exceedingly apt to pass up in the ears. Too much stress cannot be laid upon this source of danger, for, with the general disuse of that dangerous instrument, the nasal douche, in children, the impression is received that the pharyngeal syringe is a safe substitute. It is in the writer's judgment but little less dangerous than the douche, indeed, the source of the danger to the ears is precisely the same in the two instances. No doubt the physician *can* use the douche without danger, as he can the syringe, but if he habitually uses an instrument from which no aural complication can possibly arise, he is then and then only absolutely safe.

A few moments after the first application or toward the close of the first sitting, the handkerchief having been used by the child, large quantities of mucus or muco-pus is removed, and the little patient is made relatively comfortable for a period extending from several hours to a day. Any detergent dissolved in tepid water suffices for the purpose.

No specific action of drugs is to be anticipated. Weak solutions of carbolic acid and glycerine, namely, about a drop of the acid to two drops of glycerine dissolved in an ounce of water, is as good as any. Boracic acid in almost any strength; common table salt; potassium chlorate; are all in use with physicians, and are found efficient. It is not so much the remedy selected but the manner of using it that should receive attentive care. The use of astringents so universally mentioned, such as the preparations of tannin, of zinc, etc., can be, in the judgment of the writer, discarded. The preparations of iron, without exception, are mischievous.

(2) The condition of the floor of the nasal vestibule almost always demands attention. The use of mercurial ointments, such as are employed by oculists for blepharitis and granular lids, is followed by most encouraging results. The ointment of the red oxide of mercury in the proportions of one grain of the salt to one drachm of cosmoline is well borne. The ointment is best applied with a camel-hair brush to the interior of the nostril before retiring. An occasional application in the office to parts not accessible by an untrained hand is advantageous.

(3) The operations for misplaced nasal septum present no peculiar features in children, and the consideration of the procedures need not be undertaken here.

(4) In order to correct the discharge, which is apt to be of a simple character, it is necessary to care for the general health.—The extent to which the tonsils should be reduced in size is to be determined by the degree in which they obstruct respiration. Should

the premises given above respecting the etiology of the affection be accepted, it is evident that the tonsils need not and indeed should not be excised unless they are known to interfere with respiration, in which event they should be removed without hesitation.

NOTES OF A CASE

OF

INFLAMMATION OF THE CERVICAL PORTION OF THE SPINAL CORD, THE RESULT PROBABLY OF AN INJURY: FOLLOWED BY TETANIC SYMPTOMS.

By

J. CHESTON MORRIS, M.D.

[Read January 2, 1884.]

I DESIRE to call the attention of the Fellows to the following report of an interesting case in which the diagnosis was obscure:—

On Sunday, Nov. 25, I was consulted by Dr. —— about the case of his daughter, an intelligent, lively girl aged 12, of spare, nervous habit, but generally good health, except that about a year previously she had suffered from slight chorea. He thought she had mumps, but was afraid that the stiffness of her jaws and slight pain in the back and neck, which were all the symptoms complained of, might be due to diphtheria or else to cerebro-spinal meningitis. I told him I thought it was probably only the result of a slight cold and was rheumatism; if, however, he felt uneasy he had better send for Dr. Darrach (in whose neighborhood he lived), and, if necessary, I would see her in consultation. Dr. D. telegraphed me to meet him the next morning, and he told me he had found the girl's jaws firmly locked the previous evening, and there was considerable opisthotonos. As we entered

the room a convulsive movement passed over her features, with much suffusion of the face, which soon subsided, leaving, however, a sardonic expression of countenance and marked opisthotonos. We both thought these convulsive movements might have arisen from dread of my repeating the efforts which had been vainly made the night before to open her jaws; but it was soon evident this was not the case. She complained of no pain, and bore handling and examination well, but nothing further was elicited. Her pulse was about 119, skin and temperature normal or nearly so, tongue slightly furred, respiration rather frequent, but no evidence of lung or heart trouble. She lay on her right side, her head drawn back, with the spinal muscles strongly contracted, and occasionally spasmodically drawn. The abdominal walls were somewhat harder than natural.

Our diagnosis was congestion of the cervical region of the cord, whether of choreic or rheumatic origin we were in doubt, as the symptoms and history gave no clue. Still, the indication seemed to be to allay the spasm, and we directed the administration of full doses of fluid extract of conium, alternated with full doses of opium and belladonna, and liquid nourishment. Dr. Currie assisted Dr. Darrach in charge of the case. I saw her again on Wednesday morning; her pulse had fallen to 104; skin and temperature normal; she expressed herself as rather easier, and wished to be moved to the other side of the bed, which was accomplished, to her relief. The trismus had yielded very slightly; the spasms occurred at longer intervals, but were rather more marked. Dr. D. thought there had been some increase of reflex cutaneous sensibility the day before in the lower extremities, but this had passed away. Careful examination showed absence of the patellar tendon reflex, but the sensitiveness of the skin to touch was normal. Our conclusion was that the spinal congestion had passed or was passing into the stage of effusion, but as it did not seem to be extending we hoped for a good result. The bowels had not been moved, and were becoming distended with flatus; enemata

of flaxseed-tea and assafœtida were, therefore, ordered, and previous treatment continued. She, however, soon after became worse; delirium supervened, and she died in a convulsive attack on Thursday, November 29, at 4 A. M.

I requested an autopsy, permission for which was given December 2, "if I still thought it necessary after learning that some three weeks previous to her sickness she had had a severe fall forwards, striking her head so as to make her nose bleed severely; the blood also settled under her eyes." The autopsy, at which only the cervical cord was allowed to be examined, took place at 4 P. M., three days and a half after death. On opening the spinal canal by an incision through the back of the neck and sawing through the vertebral processes on each side, a bloody serum escaped from it; the lining membrane of the canal and the dura mater of the cord were deeply congested, and the cord itself felt softened; it was detached as carefully as possible, and the finger passed up through the foramen magnum into the cranial cavity. The foramen was smooth, but just below it on the anterior wall of the canal, the odontoid process of the second cervical vertebra was denuded, and felt rough to the finger, almost carious. Unfortunately, as permission had not been obtained for examining the brain, and it was important to avoid disfiguring the body, no ocular demonstration could be made. The portion of the cord removed was placed in the hands of Dr. Morris Longstreth with the above history.

The case seems to me to be a very interesting and instructive one. An injury by *contre-coup* to the odontoid process, followed by inflammation of the spinal cord and tetanic symptoms coming on insidiously three weeks after the injury, in the case of an individual of choreic, rheumatic antecedents, was perhaps hardly to have been diagnosticated more correctly with the information we had. I may add, that

her uncle, the son of one of the Fellows of this College, died of fracture of the cervical spine, the result of an accident, some thirty years ago.

I also subsequently learned that she had complained of pain in the back of the neck, after the fall, to the cook, and her mother informed me when I first saw her that she had for several days previously spoken of slight pain in the upper and middle part of the spine, which she supposed to be rheumatic or due to a slight cold taken while gathering walnuts. She also noticed on these days a peculiar drawn expression of the face, which occurred while she was at table, when the stiffness of the jaws was first noticed which gave rise to the supposition that she might be getting mumps.

Dr. Morris Longstreth submits the following note on the examination of a portion of the cervical spinal cord.

The substance of the cord is slightly softened. The larger vessels of the pia-arachnoid are very full of blood and very conspicuous. The general aspect of the surface is pinkish, indicating an injection of the smaller vessels. A cross-section of the cord presents nothing to note. The inner membranes can be more easily separated from the cord than normal, and it is apparent from their examination that there exists a slight exudation which renders their tissue somewhat opaque.

The microscopic sections were made, after a short immersion in alcohol and subsequently in Muller's fluid, by freezing. The tissues of the membranes appear swollen, their fibres are separated, and in places the interstices show a minute amount of exudation materials. The inflammatory material is seen also on their outer surface, but the amount of it is not considerable. It is composed of fibrinous threads in which are entangled a small number of nuclei. The

bloodvessels are large, the swelling also affects their walls, and many of them contain blood corpuscles and clots. The specimens—those that were stained with a carmine fluid—show these parts deeply colored, and the nuclei are unusually conspicuous.

On the inner surface of the membranes toward the cord, the inflammatory changes of the same character are also seen; they extend into the substance of the cord but a short distance. The portion of the cord at its surface is markedly granular. The same changes are found in the portions of the membranes which extend into the anterior and posterior fissures of the cord, but at these parts the morbid condition is less distinct. The bloodvessels, ramifying in the substance of the cord show slight alterations of a similar character, and around them at a few places there appears a very slight exudation in which the nuclei stain deeply.

The nerve tubules and the ganglion cells of the cord show no appearance of change. The tissue of the cord, however, showed some alterations. Its general appearance was more granular than normal; this change was irregularly distributed, more marked always near the surface, but uneven in the depth of its extension. It is uncertain whether it is more marked around the capillaries in the interior of the cord, where it is often conspicuous in cases of tetanus. It must be noted that the effusion around these capillaries is very slight, however. The change of this tissue can be described as a granular disintegration, and, judged by its character and its situation, was probably induced by inflammation of the membranes affecting the contiguous parts of the cord. In one or two places, bundles of nerve filaments (cross-section of the spinal nerve roots) are seen attached to the outer surface of the membranes. Around these bundles and among the fibres the inflammatory changes are especially well marked.

Remarks on the Post-mortem Changes and the Microscopic Appearances.—The post-mortem changes, taken in connection with the history and symptoms, show that the tetanic

spasms were due to the inflammatory condition of the cord. The inflammation was most marked at the portion of the cord from which are derived the filaments of the nerves distributed to the muscles alone implicated in the spasmodic contractions. It would seem that the impress was communicated directly to these nerves, probably before their exits from the dura mater, since we see the inflammatory changes conspicuous around some of the filaments of which they are made up.

The changes in the cord, as here seen, are not of the character found in tetanus; at least they do not equal in degree those usually found. Here the vascular exudation is very slight or entirely wanting, and the granular disintegration is slight and localized, and evidently communicated from the inflammation of the membranes. In tetanus we have no inflammation, the changes consisting of exudation, mostly or entirely fluid, which leads to granular alterations of the tissues of the cord. Here we have a very evident, though slight, inflammation which has produced somewhat similar alterations of the cord, partial and much less in degree and only approaching the tetanus changes in kind.

A FURTHER NOTE ON THE SPECIFIC TREATMENT OF ENTERIC FEVER.

By

JAMES C. WILSON, M.D.,

PHYSICIAN TO THE JEFFERSON MEDICAL COLLEGE HOSPITAL, AND TO THE PHILADELPHIA HOSPITAL.

[Read January 2, 1884.]

A YEAR ago I read before the College a brief paper On the Management of Enteric Fever according to a plan based upon the so-called Specific Treatment. That communication, which will be found in the sixth volume of the third series of the *Transactions*, beginning on page 221, was the outcome of the clinical study of a very limited series of cases in which the plan referred to had been fully carried out. The object of the present communication is to lay before you the results of the plan as employed during another year in the management of a second series of cases.

Before presenting to your attention the facts relating to this second series of cases, permit me to state that the plan of treatment consists in a close adherence to the so-called rational or expectant method of treatment in all its details, plus the systematic use of purgative doses of calomel in the early days of the attack, and of iodine and carbolic acid throughout its whole course. These drugs are administered chiefly

with the intention of realizing their effects in diminishing the activity of the supposed specific cause of the disease, and the treatment is therefore properly designated a specific treatment in contradistinction to the rational or expectant treatment on the one hand and to all forms of symptomatic treatment on the other.

The first series of cases numbered sixteen, of which all recovered.

The second series, treated during the year 1883, by a curious coincidence, also numbered sixteen, of which two died.

Of these, seven were severe, the temperature reaching or exceeding 104° F. (40° C.)

Of these seven severe cases, the two which terminated fatally were colored men, admitted to the wards of the Philadelphia Hospital late in the attack and in a state of profound stupor. One, aged 27 years, died on the seventh day after admission; the other, aged 47 years, on the twenty-first day. The latter passed albuminous urine, and presented after death the lesions of interstitial nephritis in addition to those of enteric fever.

Two non-fatal cases were attended by profuse and repeated intestinal hemorrhage in the third week. One of these, a man aged 20, had, during convalescence, necrosis of the mastoid process of the right temporal bone. One case of great severity occurred in a man aged 62 years, whose convalescence was, however, rapid and without sequels.

No instance of relapse was observed.

The characteristic eruption was present in all the severe cases. It was not discovered in four of the mild cases.

The average duration of the five severe cases in which recovery took place was about thirty-two days; that of the nine mild or medium cases was about twenty-four days.

Of the whole number, six were treated in hospital and ten in private practice.

It is worthy of note that the convalescence in these cases was rapid, as a rule without complication, and that no instance of relapse occurred. An analysis of the combined series shows as a result of this treatment in my hands thirty-two cases, sixteen treated in hospital, sixteen in private practice, with two deaths (cases admitted to hospital in profound stupor). The death-rate is therefore 6.25 per cent. I refrain from citing, for comparison, the familiar statistics of the death-rate of enteric fever. We have come to regard it as ranging from 15 to 20 per cent., with a more favorable showing in private than in hospital practice. But Welch, from the statistics of the medical service of the British army, has recently shown it to exceed 33.3 per cent.; and Dr. Francis Delafield, in an important statistical paper on this fever as it occurs in New York (see *Medical News*, November 24, 1883), has shown that the death-rate in hospital cases, though varying in different years, ranges between 20 per cent. as the lowest, and 30 per cent. as the highest limit.

[After the reading of the preceding paper—]

Dr. ARTHUR V. MEIGS said: This so-called "Specific Treatment of Typhoid Fever" appears to me a mistaken plan founded upon an untenable theory. We are asked, in the first place, to assume that typhoid fever has for its cause a germ whose very existence is not known, and second, that calomel, iodine, and carbolic acid given by the mouth will meet with and destroy this imaginary germ. Neither of these assumptions can be considered proved. Why do we not give the same drugs in cases of scarlet fever, measles, or smallpox? for there is as good reason to believe them to originate from germs, and that the same germicides would be effective for their destruction. I should not be so outspoken in my denunciation of this method of treatment if it could be looked upon as harmless, but it seems capable, on the contrary, of much mischief. Whatever may be the effect of such large doses of iodine, and carbolic acid, we were almost all taught, and have up to this time believed, the effect of purges given in the earlier stages of typhoid fever to be most disastrous. Dr. Wilson himself, I doubt not, was taught, as I was, when a resident physician in the Pennsylvania Hospital, that even a teaspoonful of castor oil given to a patient in the early stage of the fever, might cause a diarrhœa which would continue throughout the attack. Is there no reason for this belief, and is not calomel capable of producing the same effect? Dr. Wilson says the treatment of typhoid fever is at sea; to me, it seems on the contrary, there is no disease in regard to the treatment of which there is such general agreement. How many men in this room treat cases of scarlet fever alike, and how many treat typhoid fever differently? The present treatment of the disease is the treatment of common sense; so far as the local lesion is concerned, we treat it as a surgeon treats a wound, we try to give rest to the part, and avoid all causes of irritation, and nature thus is given time and opportunity to heal the ulcers. We treat symptoms as they arise, and support the strength of the patient with food and water, and stimulants if necessary, through the four or six weeks during which fever is burning his tissues until he is reduced almost to a skeleton. How can purging with calomel, or administering such nauseous drugs as carbolic acid and iodine conduce to this result? Will the patient be any better able

to go through his weeks of fever? Does Dr. Wilson show that the method shortens the duration of the disease one day or one hour? It appears like asking us to go back to the days of ignorance, which existed before Stokes, and Graves, and the great men of that day taught us how to treat the disease. Years ago, Stokes put in a few words the common sense view of the question. It must be remembered that at that time the distinction between typhus and typhoid fevers was not drawn. He says: "I confess that it was not until several years after I commenced practice that I became fully aware of the erroneousness of what is termed the anatomical theory of disease; and I feel certain, humiliating though the confession may be, that the fear of stimulants in fever with which I was imbued, was the means of my losing many patients whose lives would have been saved, had I trusted less to the doctrine of inflammation, and more to the lessons of experience, given us by men who observed and wrote before the times of Bichat or of Hunter.

"The hospital physician will be frequently asked by students to state the principle on which he administers wine in fever. Typhus fever is a disease which has a tendency to a spontaneous and favorable termination, but one in the course of which the powers of life are attacked by a most malignant influence. By wine, food, and other stimulants we support nature, until the struggle is past, so that, to use the words of an ancient author, which embody a more profound principle than appears at first sight, we 'cure the patient by preventing him from dying'; that is to say, we prolong his existence until the natural and favorable termination of the disease arrives. We do not allow our patients to die of exhaustion, and bearing in mind the depressing influence they have to struggle with, we give stimulants at the proper time and with a bold hand. We give our patients an artificial life till the period arrives when nature and health resume their sway."

If we are asked to try the method because it lessens the death-rate; I think that can hardly yet be considered as proved. The number of cases recorded by Dr. Wilson is yet too small to prove any point. In looking over some old lectures of my father, the late Dr. J. Forsyth Meigs, delivered about the year 1850, I found that he reported a series of sixty-nine cases treated in private practice, and only five deaths. This makes a death-rate of 7.24 per cent., while Dr. Wilson's series of thirty-two cases and two

deaths makes the death-rate 6.21 per cent. The number of cases treated by him is less than half. The cases reported by Dr. Meigs were treated when bleeding and purging were still customary, and even his results are but little inferior to those of Dr. Wilson, and both are infinitely better than any published hospital statistics. In the first thirty-nine of Dr. Meigs's series of cases, he had four deaths; but in the thirty coming afterwards, only one death occurred. These results bear comparison with Dr. Wilson's, particularly the second series, which came after the first, and when bleeding and purging were becoming less the medical fashion of the day, and the expectant plan was more pursued. A comparison of the first and second series of cases shows how little reliance is to be placed upon deductions drawn from the treatment of such small numbers; for in the first the death-rate was 10.25 per cent., while in the second it was only 3.33 per cent. An examination of such records as I possess enables me to recall twenty-seven cases I have treated in private practice. Of these, two died, making a death-rate of 7.40 per cent. One of the deaths was of a boy who was taken sick in a house where there were eight or nine cases of diphtheria, and diphtheritic sore-throats, almost every one living in the house at the time being more or less affected. The cause was a foul, leaky brick drain which ran through the cellar. The other death was of a man fifty years of age in whom the diagnosis was not made until about the end of the second week of the disease. During the first two weeks, he was in and out of bed, and made at least two journeys of sixty or seventy miles by rail, and finally died of perforation of the bowel, and peritonitis, which were found at a post-mortem examination. If the total number of cases reported by Dr. Meigs, and my own, be considered together, there were treated in private practice ninety-six cases with seven deaths, making an average death-rate of 7.29 per cent. Not a bad showing for the old treatment, when it is considered that typhoid fever has always been looked upon as one of the most fatal of all diseases.

CLINICAL ASPECTS OF CEREBRAL SYPHILIS.

By

HORATIO C. WOOD, M.D.,

PROFESSOR OF DISEASES OF THE NERVOUS SYSTEM IN THE UNIVERSITY OF PENNSYLVANIA.

[Read February 6, 1884.]

In the present article I propose to say very little in regard to the lesions of cerebral syphilis, only making such allusions as are necessary to the clinical study. So much practical importance attaches to the etiological relations of the disorder that I shall discuss these at some length.

We do not know why syphilis attacks one portion of the brain rather than another in any individual case; indeed, very rarely can we give any sufficient explanation why the brain is affected at all.

It is naturally to be expected that any cause of ordinary brain inflammation would, when present in a syphilitic person, tend to precipitate a specific cerebral disease. Thus, as thermic fever frequently provokes chronic meningitis, much plausibility attaches to the report of a case in the *Journ. de Med. et Chir. Prat.*, Paris, 1879, p. 291, where the cerebral syphilis is ascribed to a sunstroke. Blows and other traumatisms would, in a similar manner, be supposed to figure largely as exciting causes of brain syphilis; but I have never met with a case having such rela-

tions, and reports of them are rare in literature. The only records I have found are the cases reported by Dr. Broadbent, *London Lancet*, 1876, ii. p. 741, and a small collection in Huebner's article on Nervous Syphilis, in Ziemssen's *Encyclopedia*, xii. 301. I have seen two cases of presumably traumatic spinal syphilis; one in which a polio-myelitis[1] followed a fall on the ice; and one in which, after a fall from a cart, and marked spinal concussion, a local myelitis developed. (*Univers. Hosp. Dispen. Service Book*, x. 1875, p. 58.)

Various authorities attach much influence to over-study and other forms of cerebral strain in exciting brain syphilis. Engelstedt is stated to have reported cases having such etiological relations, and Fournier (*La Syphilis du Cerveau*) affirms that he has especially seen the disease in professional men and other persons habitually exercising their brains to excess. Neither in private nor public practice have I met with any instance where over-brain-work could be considered a distinct etiological factor, whilst the wards of the Philadelphia Hospital and the roll of the University Dispensary are full of cases occurring in persons who use not at all the modicum of brains nature has endowed them with. As far as my observation goes, cases of brain syphilis in which any exciting cause can be found are very rare.

[1] In this case the man had symmetrical specific skin eruptions upon the arm and the symptoms were peculiarly symmetrical; great coldness of both forearms; excessive sweating of the palms; loss of power, so much more pronounced in the extensors than elsewhere that the patient had been treated for lead poisoning and great wasting of the extensor muscles. Evidently a symmetrical syphilis chiefly confined to the anterior spinal cornua.

The inherited diathesis is less prone to manifest itself in the nervous system than in other portions of the body, but it certainly is capable of causing every type of nervous disease that follows infection from impure coition.

As early as 1779 Dr. Jos. Glenck (*Doctrina de Morbis Venereis*, Vienna) reported a case of a girl, six years old, cured by a mercurial course of an epilepsy of three years' standing, and of other manifestations of hereditary syphilis. Graefe found gummatous tumors in the cerebrum of a child nearly two years old. (*Arch. f. Ophthalm.*, Bd. i., erst. Abth.) Prof. O. Huebner (*Virchow's Archiv*, Bd. lxxxiv. 269) details the occurrence of pachymeningitis hemorrhagica in a syphilitic infant under a year old. Dr. Hans Chiari (*Wien. Med. Wochenschrift*, xxxi. 1881, 17) reports a case in which very pronounced syphilitic degeneration of the brain-vessels was found in a child fourteen months old. Both Dr. Barlow (*Lond. Patholog. Soc. Trans.*, 1877) and Dr. T. S. Dowse (*The Brain and its Diseases*, vol. i. p. 76) report cases of nerve syphilis in male infants of fifteen months.

It is a matter of great interest to know how late in life nervous disease from inherited taint may develop. We have, as yet, little light upon the equally interesting and cognate problem as to how far inherited syphilis may produce late in life nervous diseases whose type is not distinctly specific, but it is probable that even after puberty specific nervous affections may appear for the first time in the unfortunate offspring of syphilitic parents. Mr. Nettleship reports (*Trans. Lond. Path. Soc.*, xxxii. 13) the development

of a cerebral gumma in a girl of ten years, and Mr. J. A. Ormerod (*Ibid.*, p. 14) of a tumor of the median nerve (probably gummatous) in a woman of twenty-three, both the subjects of inherited syphilis. Dr. Thos. S. Dowse (*loc. cit.*, p. 71) details a case of cerebral gumma at the age of ten years, and Dr. Saml. Wilks (*Lectures on Dis. of Nerv. Syst.*, Philad., 1878, p. 333) one of epilepsy from inherited taint in a boy of fourteen. Dr. J. Hughlings Jackson reports (*Journ. Ment. and Nerv. Diseases*, 1875, p. 516) paraplegia with epilepsy in a boy of eight, hemiplegia in a girl of eighteen, and (*Brit. Med. Journal*, May 18, 1872) hemiplegia in a woman of twenty-two; the nervous affection in each case being associated with or dependent upon inherited syphilis. Dr. E. Mendel reports (*Archiv f. Psychiatrie*, Bd. i. 313) a case of a child who had inherited syphilis, and developed in her fifteenth year a maniacal attack with hallucinations.

Some time since, I saw, in an orphan of fourteen, a chronic basal meningitis, and, in the absence of any history, gave the fatal prognosis of tubercular disease, but to my astonishment, under the long-continued use of iodide of potassium, complete recovery occurred. No signs of inherited syphilis were perceptible, but the specific nature of the inflammation is, in view of the result, scarcely doubtful; it is probable, that in some of the reported cases of recovery from alleged tubercular meningitis, the affection has really been syphilitic.

The relation of inherited syphilis to idiocy appears to be a close one. What role the diathesis has in the production of those cases which are dependent upon

arrest of development we have no way at present of knowing, but that it very frequently causes chronic hydrocephalus seems to be well established. A number of cases have been reported; they have been collected by Dr. E. Mendel (*Archiv f. Psychiatrie*, Bd. i. 309). For a very important paper see, also, Virchow's *Archiv*, Bd. xxxviii. p. 129.

Nervous diseases following acquired syphilitic infection certainly belong to the advanced stages of the disorder. Huebner reports (Ziemmsen's *Encyclopedia*, xii. 298, New York edition) a case in which thirty years elapsed between the contraction of the chancre and the nervous explosion. I have seen a similar period of thirty years. Fournier reports intervals of twenty-five years, and thinks from the third to the tenth year is the period of maximum frequency of nerve accidents.

The fact that cerebral syphilis may occur many years after the cessation of all evidence of the diathesis is one of great practical importance, especially when taken in conjunction with the circumstance that the nervous system is more prone to be attacked when the secondaries have been very light than when the earlier manifestations have been severe. I have repeatedly seen nerve syphilis in persons whose secondaries have been so slight as to have been entirely overlooked or forgotten, and who honestly asserted that they never had had syphilis, although they acknowledged to gonorrhœa or to repeated exposure, and confessed that their asserted exemption was due to good fortune rather than chastity.

To show that my experience is not peculiar, I may be allowed to make the following citations: Dr.

Dowse (*The Brain and its Diseases*. London, 1879, vol. i. p. 7) says, "Often have I had patients totally ignorant of having at any time acquired or experienced the signs or symptoms of syphilis in its primary and secondary stages, yet the sequelæ have been made manifest in many ways; particularly in many of the obscure diseases of the nervous system." Dr. Buzzard (*Syphilitic Nervous Affections*, London, 1874, p. 80) reports a case of nervous syphilis where the patient was unconscious of the previous existence of a chancre or of any secondaries. Prof. Rinecker also calls attention (*Archiv f. Psychiatrie*, vii. p. 241) to the frequency of nervous syphilis in persons who afford no distinct history of secondary symptoms.

This frequent absence of history of specific infection is of great practical importance, and has led me to attach comparatively little weight to the statements of patients. In private practice I usually avoid asking questions which might bring up from the past unpleasant memories, and arrive at the diagnosis by studying the symptoms present.

Although syphilis is most prone to attack the nervous system many years after infection, it would be a fatal mistake to suppose that brain disease may not rapidly follow the occurrence of a chancre. What is the minimum possible intermediate period we do not know, but it is certainly very brief, as is shown by the following cases of this so-called precocious cerebral syphilis. Dr. Alfrik Ljunggrén, of Stockholm, reports (*Archiv f. Dermatol. und Syphilis*, 1870, ii. p. 155) the case of H. R., who had a rapidly healed chancre in March, followed in May of the same year by a severe headache, mental confusion, and giddi-

ness. Early in July H. R. had an epileptic attack, but he was finally cured by active anti-syphilitic treatment. Although the history is not explicit, the nervous symptoms appear to have preceded the development of distinct secondaries other than rheumatic pains.

Davaine is said (Buzzard, *Syphilitic Nervous Affections*, London, 1874) to have seen paralysis of the portio dura "a month after the first symptoms of constitutional syphilis." Dr. E. Leyden (*Zeitschrift f. Klin. Med.*, Bd. v. 165) found advanced specific degeneration of the cerebral arteries in a man who had contracted syphilis one year previously. Dr. R. W. Taylor details a case in which epilepsy occurred five months after the infection (*Journ. Nervous and Mental Dis.*, 1876, p. 38). In the case of M. X., reported by Dr. Ad. Schwarz (*De l'Hémiplegia Syphilitique Précoce*, Inaug. Diss., Paris, 1880), headache came on the fortieth day after the appearance of the primary sore, and a hemiplegia upon the forty-sixth day. S. L. (*Ibid.*) had a paralytic stroke without prodromes six months after the chancre. A. P. L. (*Ibid.*) had an apoplectic attack seven months after the chancre: A. S., one five months after her chancre. In a case which recently occurred in the practice of Dr. A. Sydney Roberts, of this city, the chancre appeared after a period of incubation of twenty-six days, and two months and eight days subsequent to this came the first fit; eight days after the first the second convulsion occurred, with a distinct aura, which preceded by some minutes the unconsciousness. The further details of this case are not germane to the present discussion, which only requires the additional

statement that the attack developed into an unmistakable cerebral syphilis with temporary aphasia, and that convalescence was finally secured by active antisyphilitic treatment. As the first paroxysm came on, without warning, whilst the man was fishing in the sun, it is not unwarrantable to suppose that a precocious cerebral syphilis was in this case precipitated by exposure to the ordinary causes of sunstroke.

The list of cases just given might be much extended, but it certainly is sufficient to show that cerebral syphilis occurs not very rarely within six months after infection, and may be present in two months.

An interesting observation in this connection is that of Dr. Ern. Gaucher (*Revue de Méd.*, 1882, ii. 678) of a spinal syphilis occurring six months after the appearance of a chancre.

Syphilographers are in accord in regard to the existence of two pathological varieties of brain syphilis, whilst some authorities believe in a third form. The most common seat of attack is the membranes; next to these are the brain-vessels; whilst, as already intimated, there is difference of opinion as to whether the disease ever directly affects the brain-tissue. Reasons will be given later on for believing that the brain-substance may suffer violence from syphilis, but I shall first discuss the clinical aspects of specific disease of the membranes.

Disease of Brain Membranes.—Specific affections of the brain membranes very often declare themselves with great suddenness. The records of the disease present case after case in which an apo-

plectic attack, a convulsive paroxysm, a violent mania, or a paralytic stroke, has been the first detected evidence of syphilitic cerebral disease. On the other hand, in many instances, the symptoms come on slowly and successively. Proper treatment, instituted at an early stage, is usually successful, so that a careful study of these prodromes is most important. They are generally such as denote cerebral disturbance; and, although they should excite suspicion, are not diagnostic, except as occurring in connection with a specific history, or under suspicious circumstances.

Headache, slight failure of memory, unwonted slowness of speech, general lassitude, and especially lack of willingness to mental exertion, sleeplessness or excessive somnolence, attacks of momentary giddiness, vertiginous feelings when straining at stool, yelling, or in any way disturbing the cerebral circulation, alteration of disposition—any of these, and *à fortiori*, several of them, occurring in a syphilitic subject, should be the immediate signal of alarm, and lead to the examination of the optic disks, for in some cases the eye-ground will be found altered even during the prodromic stage. Of course, if choked disk be found, the diagnosis becomes practically fixed, but the absence of choked disk is no proof that the patient is not suffering from cerebral syphilis. In regard to the individual prodromic symptoms, my own experience does not lend especial importance to any one of them; although, perhaps, headache is most common. There is one symptom which may occur during the prodromic stage of cerebral syphilis, but is more frequent at a later stage; a symptom which is not absolutely characteristic of the disease, but

which, when it occurs in a person who is not hysterical, should give rise to the strongest suspicion. I refer to the occurrence of repeated, partial, passing palsies. A momentary weakness of one arm, a slight drawing of the face disappearing in a few hours, a temporary dragging of the toe, a partial aphasia which appears and disappears, a squint which to-morrow leaves no trace, may be due to a non-specific brain tumor, to miliary cerebral aneurisms, or to some other non-specific affection: but in the great majority of cases where such phenomena occur repeatedly, the patient is suffering from syphilis or hysteria.

The first type or variety of the fully-formed syphilitic meningeal disease to which attention is here directed, is that of an *acute meningitis.* I am much inclined to doubt whether an acute syphilitic meningitis can ever develop as a primary lesion; whether it must not always be preceded by a chronic meningitis or by the formation of a gummatous tumor; but it is very certain that acute meningitis may develop, when there have been no apparent symptoms, and may, therefore, seem to be abrupt in its onset. Some years ago I saw, in consultation, a man who, in the midst of apparent health, was attacked by violent meningeal convulsions, with distinct evidences of acute meningitis. He was apparently saved from death by very heroic venesection, but after his return to consciousness developed very rapidly a partial specific hemiplegia, showing that a latent gumma had probably preceded the acute attack. On the other hand, an acute attack is liable at any time to supervene upon a chronic syphilitic meningitis. At the University Hos-

pital Dispensary I once diagnosticated chronic cerebral syphilis in a patient who the next day was seized with violent delirium, with convulsions and typical evidences of acute meningitis, and died four or five days afterwards. At the autopsy an acute meningitis was found to have been engrafted on a chronic specific lesion of a similar character. In the case reported by Dr. Gamel (*Tumeurs Gommeuses du Cerveau*, Inaug. Diss., Montpellier, 1875), in which intense headache, fever, and delirium came on abruptly in an old syphilitic subject and ended in general palsy and death, the symptoms were found to depend upon an acute meningitis, secondary to a large gumma.

In this connection may well be cited the observation of Dr. Molinier (*Revue Méd. de Toulouse*, xiv., 1880, 341), in which violent delirium, convulsions, and coma occurred suddenly. A very curious case is reported by Dr. D. A. Zambaco (*Des Affections Nerveuses Syphilitiques*, Paris, 1862, p. 485), in which attacks simulating those of acute meningitis appear to have been produced in a man with a cerebral gummatous tumor by a malarial complication. In such a case the diagnosis of a malarial paroxysm could only be made by the presence of the cold stage, the transient nature of the attack, its going off with a sweat, its periodical recurrence, and the therapeutic effect on it of quinine.

In the cases of *chronic meningeal syphilis* which have come under my observation, most usually after a greater or less continuance of prodromes, such as have been mentioned, epileptic attacks have occurred with a hemiplegia, or a monoplegia, which is almost invariably incomplete and usually progressive; very

frequently diplopia is manifested before the epilepsy, and on careful examination is found to be due to weakness of some of the ocular muscles. Not rarely oculo-motor palsy is an early and pronounced symptom, and a marked paralytic squint is very common. Along with the development of these symptoms there is almost always distinct failure of the general health, and progressive intellectual deterioration, as shown by loss of memory, failure of the power to fix the attention, mental bewilderment, and, perhaps, aphasia. If the case convalesce under treatment, the amelioration is gradual, the patient travelling slowly up the road he has come down. If the case end fatally, it is usually by a gradual sinking into complete nerve-paralysis, or the patient is carried off by an acute inflammatory exacerbation, or, as I saw in one case, amelioration may be rapidly occurring, and a very violent epileptic fit produce a sudden asphyxia. In this form of cerebral syphilis, death from brain-softening around the tumor is not infrequent; but a fatal apoplectic hemorrhage is rare.

The clinical varieties of cerebral meningeal syphilis are so polymorphic and kaleidoscopic that it is almost impossible to reduce them to order for descriptive purposes. Prof. Fournier separates them into the cephalic, congestive, epileptic, aphasic, mental, and paralytic, but scarcely facilitates description by so doing. Heubner makes the following types:—

"1. Psychical disturbances, with epilepsy, incomplete paralysis (seldom of the cranial nerves), and a final comatose condition usually of short duration.

"2. Genuine apoplectic attacks with succeeding hemiplegia, in connection with peculiar somnolent

conditions, occurring in often-repeated episodes; frequently phenomena of unilateral irritation, and generally at the same time paralyses of the cerebral nerves.

"3. Course of the cerebral disease similar to paralytica dementia."

In regard to these types, the latter seems to me clear and well defined, but contains those cases which I shall discuss under the head of cortical disease.

Meningeal syphilis as seen in this country does not conform rigidly with the other asserted types, although there is this much of agreement that when the epilepsy is pronounced, the basal cranial nerves are not usually paralyzed, the reason of this being that epilepsy is especially produced when the gummatous change is in the ventricles or on the upper cortex. In basal affections, the epileptoid spells, if they occur at all, are usually of the form of *petit mal;* but this rule is general, not absolute. The apoplectic somnolent form of cerebral syphilis, for some reason, is rare in this city; and it seems necessary to add to those of Prof. Heubner's a fourth type to which a large proportion of our cases conform. This type I would characterize as follows:—

4. Psychical disturbance without complete epileptic convulsions, associated with palsy of the basal nerves and often with partial hemiplegia.

The most satisfactory way of approaching this subject is, however, to study the important symptoms in severalty, rather than to attempt to group them so as to make typical, recognizable varieties of the disease, and this method I shall here adopt.

Headache is the most constant and usually the earliest symptom of meningeal syphilis; but it may

be absent, especially when the lesion is located in the reflexions of the meninges, which dip into the ventricles, or, when the basal gumma is small and not surrounded with much inflammation. The length of time it may continue without the development of other distinct symptoms is remarkable. In one case (Book Y, p. 88, 1879), at the University Dispensary, the patient affirmed that he had had it for four years before other causes of complaint appeared. It sometimes disappears when other manifestations develop. It varies almost indefinitely in its type, but is, except in very rare cases, at least so far paroxysmal as to be subject to pronounced exacerbations. In most instances it is entirely paroxysmal; and a curious circumstance is, that very often these paroxysms may occur only at long intervals; such distant paroxysms are usually very severe, and are often accompanied by dizziness, sick stomach, partial unconsciousness, or even by more marked congestive symptoms. The pain may seem to fill the whole cranium, may be located in a cerebral region, or fixed in a very limited spot. Heubner asserts that when this headache can be localized, it is generally made distinctly worse by pressure at certain points, but my own experience is hardly in accord with this. Any such soreness plainly cannot directly depend upon the cerebral lesion, but must be a reflex phenomenon, or due to a neuritis. According to my own experience, localized soreness indicates an affection of the bone or of its periosteum. In many cases, especially when the headache is persistent, there are distinct nocturnal exacerbations.

It will be seen that there is nothing absolutely

characteristic in the headache of cerebral syphilis; but excessive persistency, apparent causelessness, and a tendency to nocturnal exacerbation, should in any cephalalgia excite suspicion of a specific origin; a suspicion which is always to be increased by the occurrence of slight spells of giddiness, or by delirious mental wandering accompanying the paroxysms of pain. When an acute inflammatory attack supervenes upon a specific meningeal disease, it is usually ushered in by a headache of intolerable severity.

When the headache in any case is habitually very constant and severe, the disease is probably in the dura mater or periosteum, and this probability is much increased if the pain be local and augmented by firm, hard pressure upon the skull over the seat of the pain.

Disorders of Sleep.—There are two antagonistic disorders of sleep, either of which may occur in cerebral syphilis, but which have only been present in a small proportion of the cases that I have seen. Insomnia is more apt to be troublesome in the prodromic than in the later stages, and is only of significance when combined with other more characteristic symptoms. A peculiar somnolence is of much more determinate import. This may occur in non-specific leptomeningitis, and in states of altered brain nutrition from senile or other degenerations of the walls of the cerebral vessels, and is therefore not pathognomonic of cerebral syphilis, yet of all the single phenomena of the latter disease it is the most characteristic. Its absence is of no import in the theory of an individual case.

As I have seen it, it occurs in two forms: In the one variety the patient sits all day long or lies in bed in a state of semi-stupor, indifferent to everything but capable of being aroused, answering questions slowly, imperfectly, and without complaint, but in an instant dropping off again into his quietude. In the other variety the sufferer may still be able to work, but often falls asleep while at his tasks, and especially towards evening has an irresistible desire to slumber, which leads him to pass, it may be, half of his time in sleep. This state of partial sleep may precede that of the more continuous stupor, or may pass off when an attack of hemiplegia seems to divert the symptoms. The mental phenomena in the more severe cases of somnolency are peculiar. The patient can be aroused, indeed in many instances he exists in a state of torpor rather than of sleep; when stirred up he thinks with extreme slowness, and may appear to have a form of aphasia; yet, at intervals, he may be endowed with a peculiar automatic activity, especially at night. Getting out of bed; wandering aimlessly and seemingly without knowledge of where he is and unable to find his own bed; passing his excretions in a corner of the room, or in other similar place, not because he is unable to control his bladder and bowels, but because he believes that he is in a proper place for such act—he seems a restless automaton rather than a man.

Apathy and indifference are the characteristics of this state, and yet the patient will sometimes show excessive irritability when aroused, and will at other periods complain bitterly of pain in his head, or will groan as though suffering severely in the midst of his

stupor, at a time too when he is not able to recognize the seat of the pain. I have seen a man with a vacant apathetic face, almost complete aphasia, persistent heaviness and stupor, arouse himself when the stir in the ward told him that the attending physician was present, and come forward in a dazed, highly pathetic manner, by signs and broken utterance begging for something to relieve his head. Heubner speaks of cases in which the irritability was such that the patient fought vigorously when aroused; this I have not seen.

This somnolent condition may last many weeks. Dr. T. Buzzard (*Clinical Lectures on Dis. Nerv. Syst.* London, 1882) details the case of a man who, after a specific hemiplegia, lay silent and somnolent for a month, and yet finally recovered so completely as to win a rowing match on the Thames.

In its excessive development, syphilitic stupor puts on the symptoms of advanced brain softening, to which it is indeed often due. Of the two cases with fatal result of which I have notes, one at the autopsy was found to have symmetrical purulent breaking down of the anterior cerebral lobes; the other, softening of the right frontal and temporal lobes due to the pressure of a gummatous tumor, and ending in a fatal apoplexy.

This close connection with cerebral softening explains the clinical fact that apoplectic hemorrhage is very apt to end the life in these cases of somnolent syphilis. Dr. Buzzard's case given above, and others which might be cited, prove, however, that a prolonged deep stupor in persons suffering from cerebral syphilis does not prove the existence of extensive brain softening, and is not incompatible with sub-

sequent complete recovery. As an element of prognosis, it is of serious but not of fatal import.

Paralysis.—When it is remembered that a syphilitic exudation may appear at almost any position in the brain, that spots of encephalic softening are a not rare result of the infection, that syphilitic disease is a common cause of cerebral hemorrhage—it is plain that a specific palsy may be of any conceivable variety, and affect, either the sensory, motor, or intellectual sphere. The mode of onset is as various as the character of the palsy. The attack may be instantaneous, sudden, or gradual. The gradual development of the syphilitic gumma would lead us, *à priori*, to expect an equally gradual development of the palsy; but experience shows that in a large proportion of the cases the palsy develops suddenly, with or without the occurrence of an apoplectic or epileptic fit. Under these circumstances it will be usually noted that the resulting palsy is incomplete; in rare instances it may be at its worst when the patient awakes from the apoplectic seizure, but mostly it progressively increases for a few hours, and then becomes stationary. These sudden partial palsies probably result from an intense congestion around the seat of disease, or from stoppage of the circulation in the same locality; but whatever their mechanism may be, it is important to distinguish them from palsies which are due to hemorrhage. I believe this can usually be done by noting the degree of paralysis.

A suddenly developed, *complete* hemiplegia, or other paralysis, may be considered as in all probability either hemorrhagic or produced by a thrombus so large that the results will be disorganization

of the brain substance, and a future no more hopeful than that of a clot. On the other hand, an *incomplete* palsy may be rationally believed to be due to pressure or other removable cause, and this belief is much strengthened by a gradual development. The bearing of these facts upon prognosis it is scarcely necessary to point out.

Although the gummæ may develop at almost any point, they especially affect the base of the brain, and are prone to involve the nerves which issue from it. Morbid exudations, not tubercular nor syphilitic, are very rare in this region. Hence a rapidly but not abruptly appearing strabismus, ptosis, dilated pupil, or any paralytic eye symptom in the adult, is usually of syphilitic nature. Syphilitic facial palsy is not so frequent, whilst paralysis of the nerve from rheumatic and other inflammation within its bony canal is very common. Paralysis of the facial may therefore be specific, but existing alone is of no diagnostic value. Since syphilitic palsies about the head are in most instances due to pressure upon the nerve trunks, the electrical reactions of degeneration are present in the affected muscles.

There is one peculiarity about specific palsies which has already been alluded to as frequently present, namely, a temporary, transient, fugitive, varying character and seat. Thus an arm may be weak to-day, strong to-morrow, and the next day feeble again, or the recovered arm may retain its power, and a leg fail in its stead. These transient palsies are much more apt to involve large than small brain territories. The explanation of their largeness, fugitiveness, and incompleteness is that they are not directly due to

clots or other structural changes, but to congestions of the brain tissues in the neighborhood of gummatous exudations. It is easily seen why a squint will remain when the accompanying monoplegia disappears.

Motor palsies are more frequent than sensory affections in syphilis, but hemianæsthesia, localized anæsthetic tracts, indeed any form of sensory paralysis may occur. Numbness, formications, all varieties of parasthesia are frequently felt in the face, body, or extremities. Violent peripheral neuralgic pains are rare, and generally when present denote neuritis. Prof. Hugnenin, however, reports (*Schwiez. Corr. Blat.*, 1875) a case in which a severe trigeminal anæsthesia dolorosa had existed during life, as the only cerebral symptom, and death occurring from lung disease, a small gumma was found pressing upon the Gasserian ganglion.

The special senses are liable to suffer from the invasion of their territories by cerebral syphilis, and the resulting palsies follow courses and have clinical histories parallel to those of the motor sphere. The onset may be sudden, or gradual, the result temporary or permanent. Dr. Chas. Mauriac (*loc. cit.*, p. 31) reports a case in which the patient was frequently seized with sudden attacks of severe frontal pain and complete blindness, lasting from a quarter to half an hour; at other times the same patient had spells of aphasia lasting only for one or two minutes. In a case still under my care with unmistakable signs of cerebral syphilis the man was suddenly and unaccountably seized with complete deafness which after some days disappeared in the course of a few hours. Like other syphilitic palsies, therefore, paralyses of

special senses may come on suddenly or gradually, and may occur paroxysmally.

Among the palsies of cerebral syphilis must be ranked aphasia. An examination of recorded cases shows that it is subject to vagaries and laws similar to those connected with other specific cerebral palsies. It is usually a symptom of advanced disease, but may certainly develop as one of the first evidences of cerebral syphilis.

Coming on after an apoplectic or epileptic fit, it may be complete or incomplete: owing to the smallness of the centre involved and the ease with which its function is held in abeyance, a total loss of word thought is not so decisive as to the existence of cerebral hemorrhage as is a total motor palsy. Like hemiplegia or monoplegia, specific aphasia is sometimes transitory and paroxysmal. Dr. Buzzard (*loc. cit.*, p. 81) records several such cases. Dr. Chas. Manriac (*Aphasie et Hemiplégie droite Syphilit.*, Paris, 1877) details a very curious case in which a patient after long suffering from headache was seized by sudden loss of power in the right hand and fingers lasting about ten minutes only, but recurring many times a day. After this had continued some time the paroxysms became more completely paralytic, and were accompanied by loss of power of finding words, the height of the crises in the palsy and aphasia being simultaneously reached. For a whole month these attacks occurred five or six times a day, without other symptoms except headache, and then the patient became persistently paralytic and aphasic, but finally recovered.

To describe the different forms of specific aphasia

and their mechanism of production would be to enter upon a discussion of aphasia itself, a discussion out of place here. Suffice it to say that every conceivable form of the disorder may be induced by syphilis.

Owing to the centres of speech being situated in the cortical portion of the brain, aphasia in cerebral syphilis is very frequently associated with epilepsy. Of course right-sided palsy and aphasia are united in syphilitic as in other disorders. If, however, the statistics given by M. Tanowsky (*L'Aphasie Syphilitique*) be reliable, syphilitic aphasia is associated with left-sided hemiplegia in a most extraordinarily large proportion. Thus in 53 cases collected by Mr. Tanowsky, 18 times was there right-sided hemiplegia, and 14 times left-sided hemiplegia, the other cases being not at all hemiplegic. Judging from the autopsy on a case reported in Manriac's brochure this concurrence of left-sided paralysis and aphasia depends partly upon the great frequency of multiple brain lesions in syphilis, and partly upon the habitual involvement of large territories of the gray matter secondarily to diseased membrane. An important practical deduction is that the conjoint existence of left hemiplegia and aphasia is almost diagnostic of cerebral syphilis.

Probably amongst the palsies may be considered the disturbances of the renal functions, which are rarely met with in cerebral syphilis, and which are probably usually dependent upon the specific exudation pressing upon the vaso-motor centres in the medulla. Fournier speaks of having notes of 6 cases in which polyuria with its accompaniment, polydipsia, was present, and details a case in which the specific growth was found

in the floor of the fourth ventricle. Cases have been reported in which true saccharine diabetes has been present (Consult. Servantié, *Des rapports du Diabète et de la Syphilis.* Paris Thèse, 1876), and I can add to these an observation of my own. The symptoms, which occurred in a man of middle age with a distinct specific history, were headache, nearly complete hemiplegia, and mental failure, associated with the passage of comparatively small quantities of a urine so highly saccharine as to be really a syrup. Under the influence of the iodide of potassium the sugar in a few weeks disappeared from the urine.

Epilepsy.—Epileptic attacks are a very common symptom of meningeal syphilis, and are of great diagnostic value. The occurrence in an adult of an epileptic attack, or of an apoplectic fit, or of a hemiplegia after a history of intense and protracted headache, should always excite grave suspicion.

Before I read Prof. Fournier's work on Nervous Syphilis, I taught that an epilepsy appearing after thirty years of age was very rarely, if ever, essential epilepsy, and unless alcoholism, uræmic poison, or other adequate cause could be found was in nine cases out of ten specific; and I therefore quote with satisfaction Prof. Fournier's words: "L'épilepsie vraie, ne fait jamais son premier début à l'âge adulte, à l'âge mûr. Si un homme adulte, au dessus de 30, 35 à 40 ans, vient à être pris pour la première fois d'une crise épileptique, et cela dans la cours d'une bonne santé apparente, il y a, je vous le répète, hui ou neuf chances sur dix pour que cette épilepsie soit d'origine syphilitique."

Syphilitic epilepsy may occur either in the form of

petit mal or of the *haut mal*, and in either case may take on the exact characters and sequence of phenomena which belong to the so-called idiopathic or essential epilepsy. The momentary loss of consciousness of *petit mal* will usually, however, be found to be associated with attacks in which, although voluntary power is suspended, memory recalls what has happened during the paroxysm; attacks, therefore, which simulate those of hysteria, and which may lead to an error of diagnosis.

Even in the fully developed type of the convulsions the aura is only rarely present. Its absence is not, however, of diagnostic value, because it is frequently not present in true essential epilepsy, and it may be pronounced in specific disease. It is said that, when in an individual case the aura has once appeared, the same type or form of approach of the convulsion is thereafter rigidly adhered to. The aura is sometimes bizarre; a severe pain in the foot, a localized cramp, a peculiar sensation, indescribable and unreal in its feeling, may be the first warning of the attack.

In many, perhaps most, cases of specific convulsions, instead of a paroxysm of essential epilepsy being closely simulated, the movements are in the onset, or, more rarely, throughout the paroxysm, unilateral; indeed, they may be confined to one extremity. This restriction of movement has been held to be almost characteristic of syphilitic epilepsy, but it is not so. Whatever diagnostic significance such restriction of the convulsion has, is simply to indicate that the fit is due to a cortical organic lesion of some kind. Tumors, scleroses, and other organic lesions of the brain cortex are as prone to cause

unilateral or monoplegic epilepsy when they are not specific as when they are due to syphilis.

Sometimes an epilepsy, dependent upon a specific lesion implicating the brain cortex, may be replaced by a spasm which is more or less local and is not attended with any loss of consciousness. Thus, in a case now convalescent in the University Hospital, a man, aged about thirty-five, offered a history of repeated epileptic convulsions, but at the time of his entrance into the hospital, instead of epileptic attacks, there was a painless tic. The spasms, which were clonic, and occurred very many times a day—sometimes every five minutes—were very violent and mostly confined to the left facial nerve distribution. The trigeminus was never affected, but in the severer paroxysms the left hypoglossal and spinal accessory nerves were profoundly implicated in all of their branches. Once, fatal asphyxia from recurrent laryngeal spasm of the glottis was apparently averted only by the free inhalation of the nitrite of amyl. The sole other symptom was headache, but the specific history was clear, and the effect of anti-syphilitic remedies rapid and pronounced.

Psychical Symptoms.—As already stated, apathy, somnolence, loss of memory, and general mental failure are the most frequent and characteristic mental symptoms of meningeal syphilis; but, as will be shown in the next chapter, syphilis is able to produce almost any form of insanity; and therefore mania, melancholia, erotic mania, delirium of grandeur, etc. etc. may develop along with the ordinary manifestation of cerebral syphilis, or may come on during an attack which has hitherto produced only the usual symptoms.

Without attempting any exhaustive citation of cases, the following may be alluded to :—

Dr. A. Erlenmeyer reports (*Die leutischen Psychosen*) a case in which an attack of violent headache and vomiting was followed by paralysis of the right arm and paresis of the left leg, with some mental depression ; a little later the patient suddenly became very cheerful, and shortly afterwards manifested very distinctly delirium of grandeur with failure of memory. Dr. Batty Luke reports (*Journ. Ment. Sci.*, Jan. 1874, p. 560) a case in which, with aphasia, muscular wasting, strabismus, and various palsies, there were delusions and hallucinations.

In the same journal, April, 1869, Dr. S. D. Williams reports a case in which there were paroxysmal violent attacks of frontal headache. The woman was very dirty in her habits, only ate when fed, and existed in a state of hypochondriacal melancholy.

M. Leiderdorf details a case with headache, partial hemiplegia, great psychical disturbance, irritability, change of character, marked delirium of grandeur, epileptic attacks, and finally dementia, eventually cured with iodide of potassium. (*Medizin. Jahrbücher*, xx. 1864, p. 114.) Several cases illustrating different forms of insanity are reported by Dr. N. Manssurow. (*Die Tertiäre Syphilis*, Wein, 1877.)

That the attacks of syphilitic insanity, like the palsies of syphilis, may at times be temporary and fugitive. is shown by a curious case reported by Dr. H. Hayes Newington (*Journ. Ment. Sci. London*, xix. 555), in which, along with headache, failure of memory, and ptosis in a syphilitic person, there was a brief paroxysm of noisy insanity.

Diseases of Brain Substance.—The psychical symptoms which are produced by syphilis are often very pronounced in cases in which the paralysis, headache, epilepsy, and other palpable manifestations show the presence of gross brain lesions. In the study of syphilitic disease of the brain membranes, sufficient has been said in regard to these psychical disturbances, but the problem which now offers itself for solution is as to the existence or non-existence of syphilitic insanity, *i. e.*, of an insanity produced by specific contagion without the obvious presence of gummatous disease of the brain membranes. Very few alienists recognize the existence of a distinct affection entitled to be called syphilitic insanity, and there are some who deny that insanity is ever directly caused by syphilis. It is certain that insanity often occurs in the syphilitic, but syphilis is abundantly joined with alcoholism, poverty, mental distress, physical ruin, and various depressing emotions and conditions which are well known to be active exciting causes of mental disorder. It may well be that syphilis is in such way an indirect cause of an insanity which under the circumstances could not be properly styled syphilitic.

If there be disease of the brain cortex produced directly by syphilis, of course such disease must give rise to mental disorders, and, if the lesion be situated in such a way as to affect the psychic and avoid the motor regions of the brain, it will produce mental disorder without paralysis, *i. e.*, a true insanity: again, if such brain disease be wide-spread, involving the whole cortex, it will cause a progressive mental disorder, accompanied by gradual loss of power in

all parts of the body and ending in dementia with general paralysis; or, in other words, it will produce an affection more or less closely resembling the so-called General Paralysis of the Insane, or Dementia Paralytica.

As a man having syphilis may have a disease which is not directly due to the syphilis, when a syphilitic person has any disorder, there is only one positive way of determining how far said disorder is specific, namely, by studying its amenability to anti-syphilitic treatment. In approaching the question whether a lesion found after death is specific or not, of course such a therapeutic test as that just given is inapplicable. We can only study as to the coexistence of the lesion in consideration with other lesions known to be specific. Such coexistence of course does not absolutely prove the specific nature of a nutritive change, but renders such nature exceedingly probable.

What has just been said foreshadows the method in which the subject in hand is to be here examined, and the present chapter naturally divides itself into two sections: the first considering the coexistence of anatomical alterations occurring in the cerebral substance with syphilitic affections of the brain membranes or bloodvessels, the second being a clinical study of syphilitic insanity.

In looking over the literature of the subject I have found the following cases in which a cerebral sclerotic affection coincided with a gummatous disease of the membrane. Gross and Lancereaux (*Affect. Nerv. Syphilis*, 1861, p. 245) report a case having a clear syphilitic history, in which the dura mater was

adherent to the skull. The pia mater was not adherent. Beneath, upon the vault of the brain, was a gelatinous exudation. The upper cerebral substance was indurated, and pronounced by M. Robin after microscopic examination to be sclerosed. At the base of the brain were very atheromatous arteries and spots of marked softening.

Dr. Jos. J. Brown (*Journ. Ment. Sci.*, July, 1875, p. 271) reports a case in which the symptoms were melancholia, excessive irritability, violent outbursts of temper, very positive delusions, disordered gait ending in dementia. At the autopsy, which was very exhaustive, extensive syphilitic disease of the vessels of the brain and spinal cord was found. The pia mater was not adherent to the brain. The convolutions, particularly of the frontal and parietal lobes, were atrophied with very wide sulci, filled with bloody serum. The neuroglia of these convolutions was much increased and "appeared to be more molecular than normal, the cells were degenerated and in many places had disappeared, their places being only occupied by some granules." These changes were most marked in the frontal convolutions.

H. Schule reports (*Allgem. Zeitschrift f. Psychiatrie* xxviii., 1871–2) a very carefully and meritoriously studied case. The symptoms during life exactly simulated those of dementia paralytica. The affection commenced with an entire change in the disposition of the patient; from being taciturn, quiet, and very parsimonious, he became very excited, restless, and desiring continuously to buy in the shops. Then failure of memory, marked sense of well-being, carelessness and indifference for the future, developed

consentaneously with failure of the power of walking, trembling of the hands, inequality of the pupils, and hesitating speech. There was next a period of melancholy, which was in time followed by continuous failure of mental and motor powers, and very pronounced delirium of grandeur, ending in complete dementia. Death finally occurred from universal palsy, with progressive increase of the motor symptoms. At the autopsy, characteristic syphilitic lesions were found in the skull, dura mater, larynx, liver, intestines, and testicles. The brain presented the macroscopic and microscopic characters of sclerosis and atrophy; the neuroglia was much increased, full of numerous nuclei, the ganglion cells destroyed. The vessels were very much diseased, some reduced to cords; their walls were greatly thickened, and full of long spindle-shaped cells, sometimes also containing fatty granules.

Dr. C. E. Stedman and Robt. T. Edes report (*Amer. Journ. Med. Sci.*, lxix., 433) a case in which the symptoms were failure of health, ptosis, trigeminal palsy with pain (anæsthesia dolorosa), finally mental failure with gradual loss of power of motion and sensation. At the autopsy the following conditions were noted: apex of the temporal lobe adherent to dura mater and softened; exuded lymph in neighborhood of optic chiasm; sclerosis of right Gasserian ganglion, as shown in a marked increase of the neuroglia; degeneration of the basal arteries of the brain.

These cases are sufficient to demonstrate that sclerosis of the brain substance not only may coexist with a brain lesion, which is certainly specific in its char-

acter, but may also present the appearance of having developed *pari passu* with that lesion, and from the same cause.

It has already been stated in this memoir that cerebral meningeal syphilis may coexist with various forms of insanity, and cases have been cited in proof thereof. It is of course very probable that in some of such cases there has been that double lesion of membrane and gray brain matter which has just been demonstrated by report of autopsies; further, if we find that there is a syphilitic insanity, which exists without evidences of meningeal syphilis, and is capable of being cured by anti-specific treatment, such insanity must be considered as representing the disease of the gray matter of the brain. Medical literature is so gigantic that it is impossible to exhaust it, but the following list of cases is amply sufficient to prove the point at issue, namely, that there is a syphilitic insanity, which exists without obvious meningeal disease and is capable of being cured by anti-syphilitic treatment.

No.	Reporter and Journal.	Symptoms.	Results. Remarks.
1	Louis Streisand..... Die Lues als Ursache der Dementia. Inaug Diss. Berlin, 1878.	Epilepsy, delirium of exaltation, alteration of speech, headache, failure of memory.	Rapid cure with mercury.
2	Ibid.....	Delusions, delirium, general mania, great muscular weakness.	Cure with mercury.
3	Dr. Müller of Leutkirch.... Journ. of Mental Dis., 1873-1, 561.	Symptoms resembling general paralysis, and diagnosis of such made until a sternal node was discovered.	Cure by iodide of potassium.
4	Fr. Esmarch and W. Jersen Allgem. Zeitschrift f. Psychiatrie.	Sleeplessness, great excitement, restlessness, great activity, incoherence and violence.	Cure by mercury.
5	M. Leidesdorf..... Medizin. Jahrbücher, xx., 1864, 1.	Complete mania, played with his excrement, and entirely irrational.	Complete cure by iodide of potassium.
6	Dr. Beauregard..... Gaz. Hebdom.de Sci.Med. de Bordeaux, 1880, p. 64.	Symptoms resembling those of general paralysis.	Cure by iodide of potassium.
7	M. Rendu ..... Ibid.	Loss of memory, headache, irregularity of pupils, ambitious delirium, periods of excitement, others of depression, embarrassment of speech, access of furious delirium ending in stupor.	Mercurial treatment, cure.
8	Ibid.....	Hypochondria, irregularity of pupils, headache, failure of memory, melancholy, stupor	Mercurial treatment, cure.
9	Dr. Albrecht Erlenmeyer.. Die luëteschen Psychosen, Neuwied, 1877.	Melancholia with hypochondriasis, sleeplessness, fear of men, and belief they were all leagued against him.	Iodide of potassium, cure.
10	Ibid.....	Religious melancholia, with two attempts at suicide, ending in mania.	Iodide of potassium, cure.
11	Ibid.....	At times very violent, yelling, shrieking, destroying everything she could get hands on, at times erotomania; no distinct history of infection, but her habits known to be bad, and had bone ozæna and other physical syphilitic signs.	Iodide of potassium, cure.
12	Ibid.....	Epileptic attack followed by a long soporose condition, ending in mental confusion, he not knowing his nearest friends, etc., almost dementia.	Cured by mercurial inunction.
13	Ibid.....	Great fear of gensd'armes, etc., mania, with hallucinations, loud crying, yelling, etc., then convulsion, followed by great difficulty of speech.	Cured by mercurial inunctions with iodide internally; subsequently return of convulsions, followed by hemiplegia and death.

No.	Reporter and Journal.	Symptoms.	Results. Remarks.
14	Ibid.	Great unnatural vivacity and loquacity, wanted to buy everything, bragged of enormous gains at play, etc.; some trouble of speech.	Iodide of potassium cure. Attended to business and seems as well as before. Relapsed. (See Symptoms)
	Ibid. Relapse of case 14.	Fifteen months after discharge from asylum relapse; symptoms developing very rapidly, delirium of grandeur of the most aggravated type with marked progressive dementia, failure of power of speech, and finally of locomotion.	Failure of various antispecific treatment.
15	Dr. A. Erlenmeyer. Die luëtischen, etc.	Failure of mental powers, inequality of pupils, trembling of lip when speaking, uncertainty of gait, almost entire loss of memory, once temporary ptosis and strabismus.	Iodide of potassium in ascending doses failed. Recovery under mercurial inunctions.
16	Ibid.	Failure of mental powers, pronounced delirium of grandeur, hallucinations of hearing, failure of memory, strabismus and ptosis coming on late.	Iodide of potassium, corrosive sublimate injections. Cure.
17	Ibid.	Failure of memory and mental powers, slight ideas of grandeur, disturbance of sensibility and motility, aphasia coming on late.	Cure with use of iodide and mercurial inunctions
18	Ibid.	Melancholy, great excitability ideas of grandeur, after a long time sudden ptosis and strabismus.	Iodide of potassium failed; mercurial course improved; joint use cured patient.
19	Ibid.	Various cerebral nerve palsies, great relief by use of mercurial inunctions, then development of great excitement, delirium of grandeur, failure of memory and mental powers, and finally death from apoplexy; no autopsy.	
20	Dr. J. B. Chapin. Amer. Journ. Insanity, vol. xv. p. 249.	Melancholia with attempted suicide, epilepsy, headache, somnolent spells.	Iodide of potassium, cure.
21	Ibid.	Acute mania, noisy, very destructive; syphilitic disease of tibia.	Iodide of potassium, cure.
22	Dr. Snell	Maniacal excitement.	Cured by specific treatment.
23	Wm. Smith. Brit. Med. Journ., July, 1868, p. 30.	Apathetic melancholy, indelicate, speaking only in monosyllables, and much of the time not at all, sullen and menacing.	Rapidly cured by conjoint use of iodide and mercurials. The symptoms first developed 3 months after chancre.

A study of the brief analyses of symptoms just given shows that syphilitic disease of the brain may cause any form of mania, but that the symptoms, however various they may be at first, end almost always in dementia, unless relieved.

Of all the forms of insanity general paralysis is most closely and frequently simulated by specific brain disease. The exact relation of the diathesis to true, incurable, general paralysis, it is very difficult to determine. It seems well established that amongst persons suffering from this disorder, the proportion of syphilitics is not only much larger than normal, but also much larger than in other forms of insanity. Thus Dr. E. Mendel (*Progres. Paral. d r Irren*, Berlin, 1880) found that in one hundred and forty-six cases of general paralysis, one hundred and nine, or 75 per cent., had a distinct history of syphilis, whilst in one hundred and one cases of various other forms of primary insanity only 18 per cent. had specific antecedents.

Various opinions might be cited as to the nature of this relation between the two disorders, but for want of space the curious reader is referred to the work just quoted and to the thesis of C. Chauvet (*Influence de la Syph. sur les Malad. du Syst. nerveux*, Paris, 1880) for an epitome of the most important recorded opinions.

Those who suffer from syphilis are exposed in much greater proportion than are other persons to the ill effects of intemperance, sexual excesses, poverty, mental agony, and other well-established causes of general paralysis. It may be that in this is sufficient explanation of the frequency of general

paralysis in syphilitics, but I incline to the belief that syphilis has some direct effect in producing the disease. However this may be, I think we must recognize as established, the opinion of Voisin (*Paralysie générale des Aliénés*, 1879) that there is a syphilitic peri-encephalitis which presents symptoms closely resembling those of general paralysis. Such cases are examples of the Pseudo-paralysie générale of Fournier (*La Syphilis du Cerveau*, Paris, 1879).

The question as to the diagnosis of these cases from the true incurable paresis is of course very important, and has been considered at great length by Voisin (*loc. cit.*), Fournier (*loc. cit.*), and Mickle. (*Brit. and For. Medico-Chirurg. Review*, 1877.)

The points which have been relied upon as diagnostic of syphilitic pseudo-general paralysis are :—

The occurrence of headache, worse at night and present amongst the prodromes.

An early persistent insomnia, or somnolence ; early epileptiform attacks.

The exaltation being less marked, less persistent, and perhaps less associated with general maniacal restlessness and excitement.

The articulation being paralytic rather than paretic.

The absence of tremulousness ; especially of the upper lip (Fournier).

The effect of antispecific remedies.

When the conditions in any case correspond with the characters just paragraphed, or when any of the distinguishing characteristics of brain syphilis, as previously given in this memoir, are present, the probability is that the disorder is specific and remedi-

able. But the absence of these marks of specific disease is not proof that the patient is not suffering from syphilis. Headache may be absent in cerebral syphilis, as also may insomnia and somnolence. Epileptiform attacks are not always present in the pseudo-paralysis, and may be present in the genuine affection; a review of the cases previously tabulated shows that in several of them the megalomania was most pronounced; and a case with very pronounced delirium of grandeur, in which the autopsy revealed unquestionably specific brain lesions, may be found in Chauvet's Thesis, p. 31.

I have myself seen symptoms of general paralysis occurring in persons with a specific history in which of these so-called diagnostic differences the therapeutic test was the only one that revealed the true nature of the disorder. In these persons a primary, immediate diagnosis was simply impossible.

Case fourteen of our table is exceedingly interesting, because it seems to represent as successively occurring in one individual both pseudo and true general paralysis. The symptoms of general paralysis in a syphilitic subject disappeared under the use of mercury, to return some months afterwards with increased violence, and with a new obstinacy that resisted with complete success antisyphilitic treatment. Such a case is some evidence that syphilis has the power to produce true general paralysis.

In conclusion, I may state that it must be considered as at present proven that syphilis may produce a *disorder whose symptoms and lesions do not differ from those of general paralysis; that true general paralysis is very frequent in the syphilitic; that the only*

perceptible difference is one of curability; that the curable sclerosis may change into or be followed by the incurable form of the disease. Whether under these circumstances it is philosophic to consider the so-called pseudo-general paralysis and general paralysis as essentially distinct affections each physician can well judge for himself.

THE TIME REQUIRED BY THE BLOOD FOR MAKING ONE COMPLETE CIRCUIT OF THE BODY.

By

ROBERT MEADE SMITH, M.D.,
PROFESSOR OF COMPARATIVE PHYSIOLOGY, UNIVERSITY OF PENNSYLVANIA.

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In a paper published in the *Philadelphia Medical Times* for January 26, 1884, I gave an account of a new method which I had employed to measure the amount of blood thrown out of the ventricles at each contraction, and to determine the time required by the blood for making one complete circuit of the body. I there had occasion to criticize the method which has heretofore been employed to answer this latter question, and to point out some of its defects. I have recently been studying this subject from another point of view, and have obtained some results which strengthen the position taken in the article referred to.

It will be remembered that the method which has been employed for this purpose, the infusion method of Hering (*Ztschrft. für Phys.* Bd. iii. and v., and *Arch. für Phys. Heilkunde*, 1853, p. 112), consists in injecting into one jugular vein towards the heart a solution of some salt whose presence in the blood

can be readily recognized by chemical tests, and in finding how soon after the injection the salt appears in the blood coming from the head in the corresponding vein on the opposite side of the neck.

When thus injected, to reach the peripheral portion of the opposite jugular vein, the salt must evidently have passed into the right heart, through the capillaries of the lungs, into the left heart, through the carotids or vertebral arteries to the head, and through the capillaries of the head or face to the jugular vein; or, in other words, must have passed through two capillary networks with their arteries and veins. It must, therefore, have completed an entire circulatory revolution. But to conclude that the time elapsing after the introduction of the salt into one jugular vein before it is found in the blood coming from the head in the opposite vein is the time required for one molecule of blood to pass from one of these points to the other, it must in the first place be admitted that the salt has been carried mechanically by the blood, without diffusing through it, with the same velocity as the blood itself; and in the second place to enable the formation of any opinion as to how often the entire mass of blood passes through the heart, it must be admitted that the velocity thus determined by the infusion method is the mean velocity of the blood mass. To show that both of these assumptions are unwarrantable is the object of the present communication.

I. *The Element of Diffusion in Hering's Method.*—Poisseuille (*Ann. d. Sciences Nat.*, 1843, ii. ser. t. xix. p. 30) was the first, and as far as I know has been the only one to offer any experimental proof as to the

falsity of the belief that the potassium salt was carried mechanically, as would be an inert body, by the blood. He repeated Hering's experiments on the horse, and was able to confirm his statement as to the time elapsing after the injection of the solution of potassium ferrocyanide before it appeared in the jugular vein of the opposite side; but he further found that this time was different for different substances, and was even modified by the presence of other substances when injected with the potassium ferrocyanide. Thus, while the time required for the circulation of the potassium ferrocyanide was *twenty-eight* seconds in the horse, when a little alcohol, in quantity insufficient to have any appreciable effect on the pulse and blood pressure as measured with the hæmadynamometer, was injected with the potash salt, the time of circulation was lengthened to *forty-five* seconds. Or, when potassium nitrate or ammonium acetate was administered under similar circumstances, the duration of circulation was reduced to *eighteen* or *twenty* seconds. In other words, he found that in the living body the rapidity of circulation of substances mixed with the blood agreed with the rapidity of flow of the same substances through dead capillaries or even through glass tubes.

It is, moreover, well known that if two fluids capable of mixing are brought into contact they will diffuse into each other with a considerable degree of rapidity, even when the mass of the liquid is at rest or when there is great difference in the relative volumes of the fluids; while if one fluid is poured into another with which it is miscible, or if agitated after the two fluids are brought into contact, diffusion is

almost instantaneous. And as some force is always employed in injecting the salt solution into the vein, the mixture of this solution with the blood will be promoted, while the motion of the blood renders the conditions still more favorable for diffusion.

The assumption is, therefore, a fair one, until subjected to experimental disproof, that the element of diffusion forms a considerable item in the rapidity with which solutions of salts complete the circuit of the body. As far as I know, however, no such proof has ever been advanced, and the direct experiments which I have made on this subject serve rather to confirm than to disprove this assumption.

It is evident that if any particular, inert substance, small enough to pass through the capillary networks, and capable of ready recognition, could be injected into the blood, there could be no question as to the element of diffusion in the time required for such a substance to complete the circuit of the body; its velocity of movement must be the velocity of the current in which it moves; and if more time is required for the circulation of such a body than for the salt solution, it will be evident that some force other than the propulsion of the blood is concerned in the movement of the salt. These conditions I believe to be filled in employing pigeon's blood as the body whose transit is measured.

The red blood corpuscles of the pigeon have a short diameter smaller than the diameter of mammalian blood disks; and as all red blood corpuscles pass edgewise, and oval corpuscles (as in the frog) pass endwise in the centre of the blood stream, it is probable that the pigeon's corpuscles will circulate in mammalian bloodvessels with their long diameter in the

axis of most rapid movement. They therefore agree with the first requisite as to size.

In the second place, they are oval and nucleated, and so form such a strong contrast to mammalian blood disks that a single pigeon's corpuscle in a drop of mammalian blood can be found under the microscope with the greatest readiness.

It might at first seem, however, that pigeon's blood injected into the vessels of a mammal is by no means an inert substance. It was proved in the earlier operations of transfusion that the blood of one species of animal is a direct poison for other species. When the blood, whether defibrinated or not, of one group of mammals is injected into the vessels of another of the same class but of different species, the corpuscles of the injected blood rapidly disappear, the plasma becoming red from the liberated hæmoglobin, which, when large quantities of blood are injected, may pass off through the kidneys, causing hæmoglobinuria, or even into the mucous and serous secretions; while at the same time the corpuscles of the animal receiving the injection, if they are themselves soluble in the injected blood, break down, and as a consequence convulsions and death through asphyxia may result.

The resistance offered to these phenomena differs in different groups of animals; thus, the dog, of all animals, is least liable to dangerous symptoms following the injection of blood from a different species. There is still another complication to be noted. Before the corpuscles are dissolved they tend to run together into heaps and so cause emboli, while again the liberation of hæmoglobin is likely to cause thrombosis.

It would seem from the above that pigeon's blood,

which was also found by Bischoff to provoke analogous symptoms when injected into mammals, is by no means an inert substance, and is therefore entirely unfitted for the use I have made of it. Such is not, however, the case. The production of the symptoms mentioned above is a question of minutes; the duration of the circulation one of seconds; and I have found by direct experiment, as will be shown later, that the circulation is completed before disorganization commences.

There is one difficulty, however, that must be guarded against. The solution of the pigeon's corpuscles occurs not only in the vessels of the dog, the animal on which most of my experiments were made, but also after blood has been drawn and exposed to the air. Therefore, if the corpuscles are not sought for within a very short time after the withdrawal of the blood, they will only be found with great difficulty, and sometimes not at all, though it may be that their presence in the same portion of blood was proved only a few minutes before. To avoid error from this cause, Dr. Gray, the Assistant Demonstrator of Histology in the University, kindly examined the blood for me the instant that the collection was made, and before alteration had commenced. Such a procedure is not, however, absolutely necessary, as the first change in the corpuscles is their loss of hæmoglobin and consequent transparency, while the cell wall disappears still later, and the nucleus remains unchanged for some time. If, therefore, a little aniline red is added to the drop of blood under examination, pigeon's corpuscles, otherwise almost invisible, can be readily recognized.

Method of Experiment.—Two pigeons were killed by decapitation immediately before the experiment, and their blood collected in a dry porcelain dish and thoroughly defibrinated by whipping with glass rods; the blood was then filtered through a fine linen cloth moistened with half per cent. salt solution (water was avoided so as to preserve the corpuscles unaltered).

The animal to be experimented on was then tied and etherized, and glass canulæ, of the same calibre as the vessels, were inserted into the external jugular veins, in the left directed towards the heart, and in the right towards the periphery, flow of blood being prevented by spring clips. A canula was then inserted into the femoral artery, and connected with a mercurial manometer writing on the kymographion.

The canula in the right external jugular vein was connected by means of a piece of rubber tubing about 4 centimeters long with a glass stopcock by which the outflow of blood could be regulated to about the amount normally passing through the vein.

The apparatus for collecting the blood and for noting the time of each collection consisted of a horizontal glass disk 31 centimeters in diameter, which could be uniformly rotated by clock-work at any desired speed. Twenty-four watch-glasses, each about 2 cm. in diameter, were fastened by sealing-wax around the edge of the disk, and the apparatus was so arranged that, as the disk rotated, the centre of each watch-glass passed under the stopcock connected with the right jugular vein.

The time was recorded in the following way: The entire disk, with the exception of the border on which the glasses were fastened, was covered with a layer

of lampblack, and an electro-magnetic lever so arranged that as the disk revolved it would describe a concentric circle on the smoked surface. This electro-magnet, with a similar lever writing on the drum of the kymographion, was included in an electric circuit broken every second by a second's pendulum. Each interruption of the circuit, therefore, made a mark simultaneously on the revolving disk and on the moving paper of the kymographion. The apparatus was further so arranged that a single movement started the revolving disk and at the same time made a mark on the already revolving drum of the kymographion. The orifice of outflow from the stopcock and the time lever were on the same radius of the disk.

A syringe containing 10 c. c. was then filled with the defibrinated pigeon's blood and bound in the canula, previously filled with the same blood, in the left external jugular. After all connections were made the kymographion was started and allowed to revolve for twenty or thirty seconds before making the injection, so as to get a normal pulse and pressure curve. The clip was then removed from the right jugular vein, and as soon as the blood commenced to flow from the glass stopcock, the clip was removed from the left jugular, the injection made, and the disk started simultaneously; the instant of starting the disk being also automatically recorded below the pulse line on the kymographion.

When all the cups were filled with blood the disk was stopped and the blood instantly examined microscopically for the presence of pigeon's corpuscles. When it was determined in which glass they first

appeared, it was only necessary to count the number of breaks in the time line on the disk from this glass to the start to determine how many seconds were required for the pigeon's corpuscles to pass from the left jugular vein to the right. While by laying off on the kymographion tracing the same number of seconds from the starting of the disk, the number of pulsations in that period was readily determined, and also whether the injection produced any disturbance of circulation.

The following are the details of two experiments made on this plan:—

Experiment I.—Nov. 24, 1883. Dog. Weight 18 kilo. Experiment conducted as described above; effects of ether had largely passed off before the experiment was made. Time required for pigeon's corpuscle to pass from the left to the right jugular 20 seconds. Pulse in 20 seconds = 55.

Before Injection.

Blood pressure.	Pulse in 15 seconds.	Respiration in 15 seconds.
160 mm.	36	6

After Injection.

5 seconds,	160 "		
10 "	155 "		
15 "	148 "	39 in first 15 seconds.	6
20 "	135 "		
30 "	90 "	43 in second 15 "	6
45 "	70 "	38 in third 15 "	7

The experiment was then interrupted for half an hour, when the low pressure produced by the pigeon's blood had passed off. 1 grm. of potassium ferrocyanide was then dissolved in 10 c. c. of normal salt solution, warmed to 38° C., and then injected into the left jugular vein, and the blood collected from the right jugular, and other details followed, as in the case of the injection of pigeon's blood.

Before Injection.

Blood pressure.	Pulse in 15 seconds.	Respiration in 15 seconds.
155	40	7

After Injection.

5 seconds, 110		
10 " 50		
15 " 30	16 in first 15 seconds.	1
20 " 20		
30 " 18	6 in second 15 "	none.
	Dead.	

The blood was then allowed to stand in the watch glasses until the serum separated; a drop of the latter was then drawn of with a pipette, placed on a porcelain dish, acidulated with dilute hydrochloric acid, and tested with a drop of dilute ferric chloride solution. It was then found that the portion of blood collected *fifteen* seconds after the injection of the potassium salt was the first to form the characteristic blue with the iron. The potassium ferrocyanide, therefore, passed from the left jugular vein to the right in *fifteen* seconds; pulse in 15 seconds = 16.

Experiment II.—Nov. 30, 1883. Dog. Weight 10 kilo. Details of experiment the same as in the preceding. The pigeon's corpuscles were found in 17 seconds; pulse in 17 seconds = 53.

Before Injection.

Blood pressure.	Pulse in 15 seconds.	Respiration in 15 seconds.
120	33	5

After Injection.

5 seconds, 120		
10 " 120		
15 " 120	44 in first 15 seconds.	6
20 " 120		
30 " 115	50 in second 15 "	7
60 " 60		

The animal was then allowed to remain undisturbed until the pressure again became normal, when 0.4 grm. potassium ferrocyanide, dissolved in 4 c. c. normal salt solution, was injected, and the blood collected as before.

Before Injection.

Blood pressure.	Pulse in 15 seconds.	Respiration in 15 seconds.
150	36	6

After Injection.

5 seconds,	120		
10 "	55		
15 "	25	18 in first 15 seconds.	2
30 "	15	15 in second 15 "	none.

Heart stopped one minute after injection.

The serum was then tested as in the previous case, and the Prussian blue found in the blood collected 9½ seconds after the injection of the potassium salt. The heart-beats in this period = 14.

The comparison of the times required in the same animal for the circulation of the pigeon's blood and the potassium salt clearly proves the falsity of the assumption that the salt moves through the vessels with the same velocity as the blood.

Vierordt (*Stromgeschwindigkeiten des Blutes*, Berlin, 1862), who, by his numerous experiments and important modifications and extensions of the plan of research, has identified himself with Hering's method, from a series of seventeen experiments made on dogs with an average body weight of 9.14 kilo. places the mean time of circulation in the dog at 15.22″, and from experiments made on three rabbits of 1.37 kilo. average weight he gives 6.91″ as the mean time of circulation. In giving these figures he states that he has been careful to exclude all experiments in which the violent symptoms produced by the injection of the poison occurred within the time that his other experiments made on the same plan, but in which such symptoms did not appear, give as the mean time

of circulation. This is, however, manifestly unwarrantable; for, were the substance injected a solid carried mechanically by the blood, any disturbance of circulation accompanied by great reduction in the pulse and blood pressure could only produce reduced velocity of the circulation, and consequently prolong the time required for the circuit of the injected solid around the bloodvessel system. But that in the face of such disturbance, and that, too, of the most violent character, the salt could be distributed with the greatest rapidity throughout the body clearly proves that it was not mechanically carried by the blood. Thus, in the experiments detailed above, we find that even when given in doses large enough to arrest the heart almost instantly, thus removing the main cause of the movement of the blood, and greatly reducing its velocity, we find, nevertheless, that the potash salt circulates more quickly even than the time given by Vierordt, and twenty-five per cent. faster than the pigeon's corpuscles are carried by the blood under normal conditions of pulse and pressure; for it should be noticed that the pulse and pressure remain comparatively undisturbed until after the circulation is complete. That the pigeon's cells are not delayed in their passage through the capillaries is proved by the fact that there is never any rise of blood pressure after making an injection of pigeon's blood, as would occur were there any blocking of the circulation in the capillaries.

The following are the results obtained in ten experiments made in the manner described above to determine the time required for the passage of the pigeon's corpuscles from one jugular vein to the other. In

each case the pulse and pressure remained undisturbed until after the circuit was completed.

No.	Animal.	Time of circulation.	Pulse in time of circulation.	Weight.
1.	Dog . .	20 seconds.	55	18 kilo.
2.	" . .	17 "	53	10 "
3.	" . .	15 "	50	8 "
4.	" . .	15 "	47	8 "
5.	" . .	18 "	44	10 "
6.	Pup . .	20 "	60	3 "
	Averages	17.5 "	51.5	9.5 kilo.
1.	Rabbit . .	14 "		
2.	" . .	12 "	—	3 "
3.	" . .	9 "	27	1½ "
4.	" . .	9 "	35	2½ "
	Averages	11 "	31	2.3 "

It is seen, in the above series of experiments made on dogs with about the same average weight as those experimented on by Vierordt (9.41 kilo., and 9.5 kilo.), that the mean time required by the pigeon's corpuscles for the jugular circuit is 17.5″, as compared with 15.22″ obtained by Vierordt for the potassium salt; while in the rabbit 11″ was obtained as a mean as compared with 6.9″. Consequently, in the dog nearly 15 per cent. of the time stated by Vierordt as expressing the mean time, and in the rabbit over 59 per cent. are due to diffusion.

In this connection it might be suggested that the rapidity of circulation is greater in small animals than in large, not only on account of the shorter path to be traversed, as insisted upon by Vierordt, but because small animals contain, both absolutely and relatively as to body-weight, a smaller volume of blood; and since it has been shown that diffusion has something to do with the result, the salt will diffuse

more rapidly into a small volume of fluid than into a large; therefore the element of diffusion is more marked in the rabbit than in the dog.

II. *The Value of the Infusion Method in Determining the Mean Time of Circulation.*—It may at the outset be admitted, with Hering and Vierordt, that if the mean velocity of the circulation could be determined for the jugular path, it would probably express the mean time required for the total amount of blood to complete the circuit of the body. For while the portion of the blood which leaves the aorta to pass through the coronary arteries to reach the right auricle follows a shorter path than the blood which passes through the capillaries of the feet or the portal system, the velocity in the large trunks is so extremely high that the difference in time in passing through two large trunks, even of such extremes of length as the carotid at its origin and the metatarsal, is so slight as scarcely to be appreciated. The great part of the time of the circulation is therefore consumed in passing through the capillaries, and the jugular path may be regarded as giving a mean between the two extremes of distance above alluded to. It therefore only remains to determine whether the mean time required for the jugular circuit has been or can be obtained by the infusion method, or by the modification which I have employed.

It has already been shown that the elements of diffusion in this method cannot be neglected, since, even after stoppage of the heart, when the only remaining propelling force acting on the blood is the rapidly decreasing difference in pressure between the arterial and venous systems, the potassium salt is carried around the circuit even in less time than is stated by

Vierordt to be the mean normal time of circulation, and in considerably shorter time than is required for the pigeon's corpuscles. But even this time required for the circulation of the pigeon's corpuscles is far above what must be the true mean time. For we know that in all cases of movement of fluids in tubes the portion of the fluid in the centre of the tube moves with a much higher velocity than the portions in contact with the walls of the tube. It is also known that the red blood corpuscles, from their greater specific gravity, are carried in this central column of greatest velocity, and, *a fortiori*, pigeon's corpuscles, having a greater specific gravity than non-nucleated mammalian cell, will have the maximum velocity of the moving column. Consequently, the time required for the circuit of the pigeon's corpuscles will be much shorter than that required for the mass of the blood.

An experiment of Schklarewsky (Hermann, *Handbuch der Physiologie*, vol. iv. p. 315) suggested to me a means by which the minimum velocity of the blood could be obtained. He found, when particles of different densities suspended in a fluid were propelled through capillary tubes, that the particles with the greatest density moved with the highest velocity, while the lighter particles moved in the peripheral portions of the stream where the velocity was the lowest. This fact serves to explain the motion of the red blood cells in the axis stream, while the lighter white blood corpuscles move along the walls of the vessels. If, therefore, a fluid containing suspended particles lighter than the red blood disks, and small enough to pass through the capillaries, is injected into the blood current, it may be assumed that

the lighter particles will be thrown out of the more rapidly moving central current into the slower moving excentric layers.

The following experiment seems to indicate that this is actually the case:—

About 1 gram of carmine was rubbed up in a mortar with 30 c. c. of normal salt solution, poured into a conical glass vessel and allowed to stand for twenty-four hours; by this time all the larger carmine particles had settled to the bottom of the glass, and the upper layers, as proved by microscopic examination, contained only carmine granules of which the largest were smaller than the mammalian red blood cells. This was determined by placing a drop of the carmine fluid with a drop of blood on a slide under the microscope. 10 c. c. of this fluid were then injected into the external jugular vein of a dog, and the time which elapsed before the carmine particles appeared in the blood drawn from the opposite jugular vein was determined in the same manner as was made use of in the experiments with the pigeon's blood.

The following are the details of the experiment:—

Experiment XI.—Dog. Weight 10 kilo.

Before Injection.

Pulse in 15 seconds.	Pressure.	Remarks.
35	110	

After Injection of 10 *c. c. of Carmine Fluid.*

36 in first	15 seconds.	110	Carmine granules found in blood
36 in second	15 "	115	drawn from opposite jugular
37 in third	15 "	118	in 35 seconds after injection.
			Pulse in 35 seconds = 85.

Without laying too much stress on this single experiment, it is at any rate probable that a mean be-

tween this extreme and the maximum velocity shown by the pigeon's corpuscles will give the mean time of the circulation. Consequently, I would place the average time required to complete the circulation in a dog of 10 kilo. weight as between 25 and 30 seconds. It will be seen that this statement can be confirmed by another line of argument.

If the amount of blood driven out of the left ventricle were a constant quantity, the rapidity of the circulation would be in direct ratio to the number of pulsations of that organ. But, as we know that the amount of blood thrown out of the heart at each contraction is subject to great variability, and as I have shown, in the paper before alluded to, that this amount falls considerably below the estimate of the ventricular capacity made post-mortem, the attempt of Vierordt to formulate a law as to a definite relation between the duration of the circulation and the number of ventricular systoles which would agree with the numbers obtained by him as expressing the time of the circulation is not warranted by the facts in the case.

Thus, Vierordt stated that in all species of animals the time required for the completion of the circulation was the time required by the heart for making *twenty-seven* pulsations; consequently, each ventricular contraction must discharge $\frac{1}{27}$ of the entire bulk of blood in the body.

Now, according to the calculations of Heidenhain, which are generally accepted as correct, the average amount of blood in a dog is $\frac{1}{13}$ of his body's weight. A dog weighing 10 kilo. will, therefore, contain 769 grams of blood; or, as the specific gravity of blood is

about 1050, 730 c. c. of blood. To propel this volume of blood once around the body in twenty-seven pulsations of the heart, at each contraction the ventricle must discharge 27 c. c. of blood, a quantity which is about double the amount which the ventricle of a dog weighing 10 kilo. can be made to contain.

There can be no doubt, however, though the statements of Vierordt in this connection are incorrect, that there must be a definite relation between the number of heart-beats and the time of circulation; for the application of the same line of argument to the data I have obtained gives a result which almost absolutely coincides with the figures obtained by direct measurement. In a dog weighing about 10 kilo., about 12 c. c. would be thrown out of the ventricle at each contraction under normal respiration; and as the amount of blood in the body would in a dog of this size be 730 c. c., sixty pulsations of the heart would be required to drive the entire amount once around the body. Placing the pulse-rate at 120 in the minute, the circulation would be completed in 30 seconds, a number which is identical with the figures given above.

It also appears that the number thus obtained by deduction as giving the number of heart-beats to complete the mean circulation is nearly in accordance with the number of pulsations required for the circulation of the pigeon's corpuscle; for, if 50 pulsations are required for the maximum velocity, and 85 for the minimum, the mean between these, 67, is near enough to the figure obtained by deduction to show that the method is nearly absolutely correct.

While there can be no doubt that an abnormal increase in the rate of the pulse, by diminishing the

amount of blood thrown out of the ventricle, will lengthen the time required by the blood to complete the circuit of the body, it cannot be urged that in my series of experiments the pulse was sufficiently accelerated by the ether to cause any retardation of the circulation. For in Experiment I., where the effect of the ether had passed off before the estimate was made, the time of circulation was even longer than in cases in which the narcosis was more profound.

There is one other point in which my experiments fail to confirm the results obtained by Vierordt. Although I cannot find in his paper before referred to any experiments to substantiate the assertion, he makes the statement (*Grundriss der Physiologie des Menschen*, 5te Auflage, 1877, S. 162) that moderate stimulation of the vagi lengthens the time of circulation by reducing the number of pulsations of the heart, but that nevertheless 26 contractions are here also required to complete the circuit; from which he makes the deduction that moderate irritation of the vagus reduces the number of the heart's contractions without modifying the amount of blood thrown out at each systole.

Of course, since I have not seen the details of the experiments on which these conclusions are based, it is impossible to form any opinion as to what is meant by "moderate" stimulation of the vagus.

As far as I know, no measurements of the quantity of blood thrown out from the heart during vagus irritation have ever been made, though a diminution of pulse rate by cold has been found by Howell and Donaldson (*Proc. Roy. Soc.*, No. 226, 1883) to augment the quantity of blood discharged at each systole. And if the irritation was not sufficiently severe to

cause much reduction in blood pressure or velocity it is conceivable that the pulse might be considerably reduced in frequency, but that the reduction would be balanced by the larger volume of blood discharged at each contraction. The only difference, therefore, in the phenomena of circulation during vagus irritation from the normal condition would be that fewer heart beats would be required to complete the circulation. The following experiments show this to be the case :—

Experiment XII.—Dec. 18, 1883. Dog. Weight 11 kilo. Pigeon's blood injected, and time of circulation estimated as before. Irritation of vagus with induction current commenced at moment of injection.

Before Injection.

Pressure.	Pulse in 15 seconds.	Respiration.	Remarks.
180 mm.	37	5	

After Injection and Vagus Irritation.

140 "	16 in first 15 seconds.		Vagus irritated 31 seconds. Corpuscle found in 19 seconds. Pulse in 19 seconds = 21; normal pulse in 19 seconds = 50.
150 "	20 in second 15 "		
140 "	32 in third 15 "		
120 "	48 in fourth 15 "		

Experiment XIII.—Dec. 20, 1883. Dog. Weight 14 kilo. Conditions of experiment the same as in preceding.

Before Injection.

Pressure.	Pulse in 15 seconds.	Respiration.	Remarks.
160	35	7	

After Injection and Irritation.

140	18 in first 15 seconds.	Vagus irritated 44 seconds. Corpuscle found in 14 seconds. Pulse in 14 seconds = 17. Normal pulse in 15 seconds = 35.
160	24 in second 15 "	
130	30 in third 15 "	
90	47 in fourth 15 "	

HISTORY OF A CASE OF PERIHEPATIC ABSCESS.

By

EDWARD T. BRUEN, M.D.,

PHYSICIAN TO THE PHILADELPHIA HOSPITAL, DEMONSTRATOR OF CLINICAL MEDICINE IN THE UNIVERSITY OF PENNSYLVANIA.

[Read April 2, 1884.]

The accompanying specimen exhibits an abscess which has occurred between the diaphragm and the liver. The abscess contained nearly a pint of laudable pus. The superior wall of the abscess was the diaphragm, and the inferior the perihepatic capsule; the hepatic substance was not involved; indeed, the liver was normal. There were evidences of catarrhal inflammation in the colon, and one or two nearly cicatrized ulcers. The only other lesion in the body was found in the right pleural cavity, the lower portion of which was obliterated by inflammatory adhesions.

The clinical diagnosis presented some interesting features.

The patient, a young man æt. 28, was admitted to the Philadelphia Hospital November 30, 1883. His previous history indicated that he had suffered from an attack of dysenteric diarrhœa four weeks before his admission, although he had convalesced from this attack. He was evidently much emaciated. The temperature until December 8th ranged from 100° to 102°; from December 14th, from 99° to 101°,

after which it never rose above 99⅘° in the evening, and was always 98° in the morning; this continued until the fatal termination of the case on the 20th instant. The pulse was usually above 100. There was occasional sweating; no chills. Extreme tenderness was felt over the hepatic region, associated with pain during the first ten days; the hepatic dulness extending four inches in the nipple line, and about five inches in the axillary region. Physical examination of the chest upon the right side revealed the evidences of a dry pleurisy; there was some cough, which was dry and hard, but not very annoying. Appetite and digestion were fairly good. Urine normal.

The diagnosis of hepatic abscess was made during the first week, chiefly because the symptoms of hepatic lesion, already detailed, were antedated by dysenteric diarrhœa. The pleural lesion was regarded as a secondary inflammatory process engendered by hepatic disease. On December 10th all symptoms of pain and tenderness had vanished; the patient's strength, appetite, and general condition markedly improved; the temperature had fallen to 99°, so that the diagnosis was revised to that of perihepatitis. From December 10th the improvement continued until the 20th, when, after an attack of vomiting, the patient suddenly died.

The autopsy appeared to prove that the inflammation which resulted in the formation of the abscess was primary in the pleura; and the secondary irritation developed the local peritoneal process.

The symptoms of abscess in the hepatic substance are frequently latent. I recall one instance of a patient, admitted October 9, 1877, who walked to the hospital and remained under treatment until the 15th, suffering from apparent remittent fever. The day of his death he rose, in the absence of the nurse, and walked down stairs to smoke a pipe; that afternoon

he had a hemorrhage from the bowels and died. The temperature of this patient was between 99° and 101°, and the clinical diagnosis was remittent fever, or typhoid of the variety called ambulatorius. The autopsy revealed an abscess about the size of a fœtal head, occupying the convexity of the right lobe of the liver.

In the case I have reported this evening, the subsidence of pain and tenderness, and the temporary improvement of the patient, certainly misled me. Under similar circumstances, I should certainly introduce an aspirator, as I was inclined to do in the beginning of this case, because I am satisfied that the healthy liver can be punctured by a fine needle without damage, whereas either a hepatic or perihepatic abscess may at any time prove fatal by rupture.

Finally, if my explanation of the etiology of this abscess is correct, the case is interesting, as showing the relation of pleurisy to serious perihepatitis.

CRITICISMS, FROM A CHEMICAL POINT OF VIEW, ON SOME FAVORITE PRESCRIPTIONS.

By

HENRY LEFFMANN, M.D.

[Read April 2, 1884.]

The few points that I present to the College this evening will include little that is absolutely new, but I think the time will not be entirely wasted, as I know that the prescription list of most of our drug-stores will give numerous examples of the violation of chemical principles here mentioned. My attention was called to this topic by my being shown by an apothecary a prescription calling for—

Syr. hypophosph.,
Tinc. férri chlor.,
Acid. phosp. dil.;

concerning which he said that in the proportions ordered he could never make the mixture up clear. I examined the precipitate, and found in it, as I had expected, a large proportion of the iron and other basic ingredients. This is a simple case of incompatibility. Turning the matter over in my mind, it has seemed to me that, while some attention is paid to cautioning students as to the general nature of incompatibility, very little or none is given, especially in the shallow chemical teaching of many medical

schools, to the properties and qualities of chemical substances in their relations to the animal tissues, and the manner of administration. I present here, therefore, a brief consideration of a few well-known remedies.

Under the name of *colorless tincture of iodine*, several preparations are used, depending for their popularity on the fact that they do not stain the skin. They are prepared either by the use of ammonia or of sodium sulphite or hyposulphite. They owe their particular property, or rather absence of property, to the neutralization of the iodine, and just to the extent that the iodine is decolorized is it to the same extent deprived of virtue. The free active affinity of the iodine, to which its local action must be due, is destroyed in these preparations, and the destruction is not slow or uncertain, but in two of the methods mentioned, it is sufficiently rapid and definite to be made the basis of a method of quantitative analysis. It is certainly difficult to see how any person could go so wide of simple chemical principles as to invent or employ this mixture.

Potassium chlorate, or, as it is still erroneously called by many, chlorate of potash, is a remedy concerning which extraordinary claims have been made, based upon most erroneous notions of its chemical qualities. It is employed in the laboratory as a source of oxygen; knowledge of this fact has led to its employment as an oxidizing agent in diseases which have been supposed to exhibit deficient oxidation. I have nothing to say here as to the clinical results obtained from potassium chlorate in any disease—although I believe it is much less in favor than for-

merly—but I enter a protest against any advocacy of its usefulness as an oxidizing agent. Under temperatures and conditions such as those which it meets in the human system, it is one of the most stable of bodies, does not part with its oxygen or chlorine, and, indeed, will not begin to do so except under very high heat. I have found by actual experiment that ten grains of the salt kept for two hours at a temperature of 100° Fahr. in contact with an artificial gastric juice did not develop oxidizing qualities sufficient to oxidize one-sixtieth of a grain of phosphorus. This experiment is merely confirmatory of what everyday experience with the substance teaches.

Potassium perm nganate has been more or less in favor with physicians for a score of years. It is well known as an oxidizing agent, its powers in this respect being well marked. It is as little suitable for internal administration for such purpose as the body just considered, but for an opposite reason. Its chemical properties are developed by almost every substance, and in the doses in which it is given it will be decomposed and rendered inert very shortly after being swallowed. Within a very recent period the salt has come into notice as a remedy for amenorrhœa, and great has been the tribulation of apothecaries. It has been given in pill form, and all the usual excipients have been unavailable. I have made a few tests of the permanganate pills now in the market, and I find with regard to those made by one of the most reliable houses in this city that the permanganate is all decomposed and converted into the insoluble manganese dioxide. The preparations of two other manufacturers made up with some mineral excipient, probably kaolin,

were in good condition, but as soon as placed in a mixture of hydrochloric acid and pepsin they began to decompose into insoluble manganese oxide. These pills vary in strength from one-eighth to one grain; this small quantity of permanganate certainly must soon decompose in the stomach, and the only virtue which it can have is from the manganese itself, and if this is effective, common sense would seem to suggest that the result could be best obtained by exhibiting some definite compound of manganese, such as the chloride or sulphate. When we consider the chemical relations of the salt and almost certain inertness of it in small doses, the gravity with which the learned English therapeutists, who recommended it in amenorrhœa, have discussed the possibility of its producing abortion becomes almost burlesque. I do not desire, of course, to impugn the clinical observations that have been recorded on this point, but I feel obliged to say that if the insoluble and variable decomposition products of one-eighth of a grain of potassium permanganate can affect the function of any one organ, then the difference between us and the apostles of the infinitesimal is small indeed.

I cannot dismiss these two compounds, which owe their popularity to mistaken notions of their properties, without saying a word or two as to the exhibition of oxidizing agents. If rational therapeutics or physiological study indicates remedies of the so-called oxidizing class, then it will be found that no better agents are known to us than those which have long been in our hands. In nitric acid, nitro-muriatic acid, and chlorinated soda we have substances which are sufficiently stable to resist the organic bodies of the

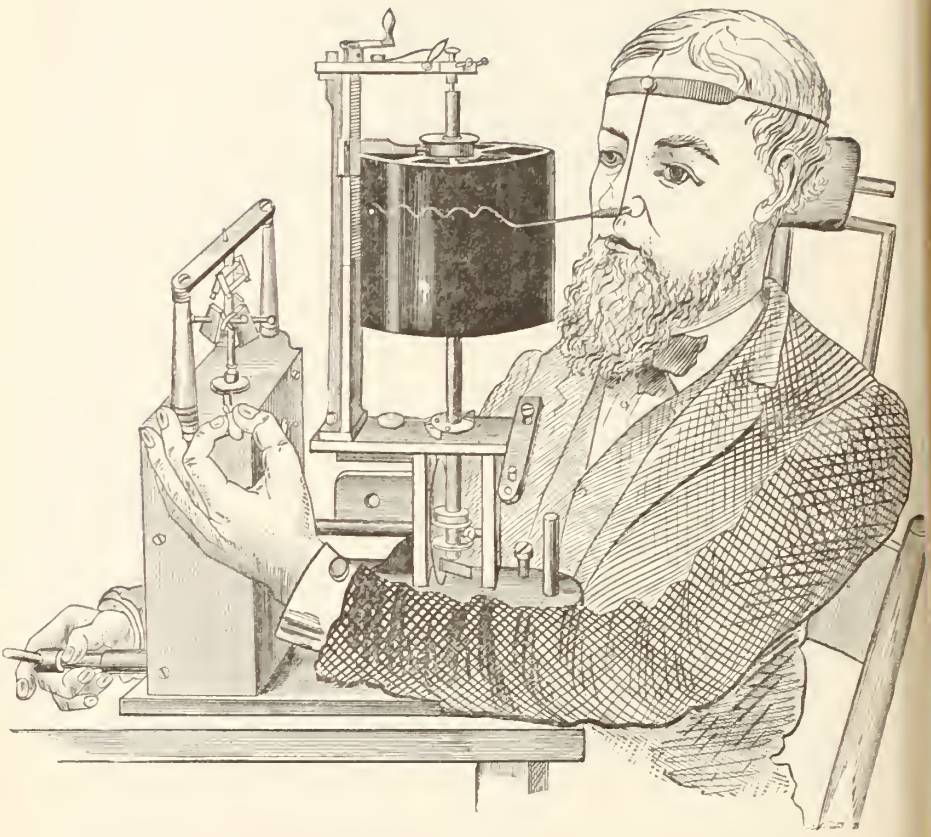
saliva and gastric juice, and are sufficiently active to give oxidizing effects if such can be obtained other than local action. I have grave doubts whether the nutritious fluids of the body can be oxidized by any method, but there can be no doubt whatever that such effect cannot be attained by either a body—potassium chlorate—which yields its oxygen only at a red heat, nor by one—permanganate—that decomposes the moment it touches any form of organic matter. Some years since a correspondent in one of our medical journals gravely recommended the use of raspberry syrup to disguise the taste of potassium permanganate. It was of course entirely successful; the taste was destroyed, so was the compound.

Caffeine citrate is a remedy much in favor, and is a remarkable instance of how much physicians take for granted in the remedies they use. There is no caffeine citrate in the market, and it is doubtful whether any such a salt can be prepared. The commercial preparations are either pure caffeine or variable mixtures of it with citric acid.

Each of the manufacturers in this city furnishes a different article, except in cases in which he buys from a common source; and a house in a neighboring city furnishes an article which contains no citric acid. Some of the samples are purely bitter in taste, while others are distinctly sour. Analyses of some of the commercial salts are recorded in a paper read before the last meeting of the American Pharmaceutical Association by Dr. G. C. Wheeler. He found the quantities of caffeine varied from 96.5 per cent. to 63.5 per cent.; of citric acid from 63.5 per cent. to

3.5 per cent.; none of these figures correspond with the proportion of a true citrate.

It seems to me that accurate clinical observation cannot be made with a preparation of so uncertain a character; for, as seen by these figures, the proportion of active ingredient may vary 33 per cent., and the lesson that these analyses teach us is that when the effects of caffeine are wanted they are best obtained by the use of the pure alkaloid, and not by a pretended and uncertain compound of it.



The Palate-Myograph in position. The left hand of the operator determines the times at which the cylinder of the kymographion will revolve. The right hand is so placed that the clock-work of the kymographion can be wound up without interfering with an observation. The chair is brought well up to the table in order that the elbows may rest easily upon it.

ON A NEW METHOD OF RECORDING THE MOTIONS OF THE SOFT PALATE.

By

HARRISON ALLEN, M.D.,

PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

[Read May 7, 1884.]

In this paper I will describe a new method of recording the motions of the soft palate.

When a straight rod is passed through the nose from before backward in the living subject as far as is possible, it will be found to impinge against the roof of the naso-pharynx. In this position the rod is not influenced by any motions of the soft palate; but if the end of the rod which remains without the nostril be raised so that the rod be brought in contact with the anterior border of the nostril, the pharyngeal end of the rod will lie in a position which will cause a decided motion to be transmitted to it when the soft palate is raised. I have for a long time been in the habit of relying upon this test to determine when an instrument thrust through the nose had reached the region of the naso-pharynx.

Having observed that the sensations upon the fingers when the rod was thus held in position varied according to the character of the sound of the voice, I instituted a series of careful comparisons, which led me to infer that the elevation of the soft palate was

greater in the sounds of ā and ē than in the sounds of ī, ō, and ū, or in any of the short vowel sounds. Substituting for the support of the fingers a flexible copper wire, one end of which was attached to the head-band, which is in common use for the support of the laryngeal mirror, and the wire itself bent round the rod so as to maintain the apposition of the rod against the anterior border of the nostril, I found that the motions of the palate caused a perceptible deviation of the free end of the rod. If, while the wire was thus supporting the rod, a rhinoscopic examination was made, the pharyngeal end of the rod was found projecting from the posterior nares into the naso-pharynx, at a point about midway between the roof and the upper surface of the relaxed soft palate. The rod being carefully adjusted so as to secure the best effects when the palate was raised, and the subject seated in front of the Ludwig kymographion (see Frontispiece), which had been previously prepared with carbon covered paper, it was ascertained that when the free end of the lever touched the cylinder, at a time when the latter was in motion from right to left and the soft palate was raised, that a distinct tracing appeared upon the cylinder and that the differences between the long and short sounds of the vowels were found to correlate with the curves made by the rod upon the kymographion.

Fig. 1 represents this rod as completed. *a* is that part of the rod, four inches in length, which is inserted within the nose. The end to the left being furnished with a bulb, and that to the right with a screw thread for attachment to *b*, which is a delicate piece of vul-

canite, marked by a number of annular depressions. The portion of the rod marked *c* extends from *b*, and represents that part of the instrument which is brought in contact with the kymographion-cylinder: it measures four inches in length, and terminates in a thin, flat, flexible end for the purpose of making a tracing.

FIG. 1.

a *b* *c*

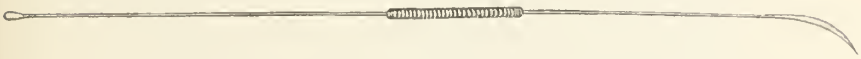


FIG. 1.—The apparatus. The two arms of the rod should be of the same length. *a*, the arm, or portion of the lever which is inserted within the nose; *b*, the vulcanite annular support for the wire-loop; *c*, the arm or portion of the lever projecting from the nostril ($\frac{2}{1}$).

When the instrument is in position (see Frontispiece) and the palate is raised (as in the voluntary motion which constitutes the first act of deglutition) a tracing is made (Fig. 2), which, when analyzed, is

FIG. 2.

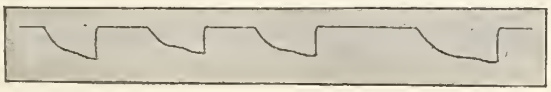


FIG. 2.—Voluntary elevation of the soft palate illustrated in the first act of deglutition.

found to be composed of a number of acute depressions interrupting a horizontal line, and which yields for examination three distinct parts: first, a long, concave, slightly undulating line—which represents the extent of downward deviation of the rod from its horizontal position; second, a short vertical line,

which represents the descent of the palate, and begins at the point at which the curved line ends and terminates at the horizontal line; and, third, the horizontal line itself, which represents the record made by the end of the rod when at rest upon the surface of the moving cylinder. It is evident that the number of the notch-like depressions will answer to as many acts of elevation as are recorded at a single trial. The differences in the depressions will be the differences in the acts of elevation themselves. The degree of elevation and the abruptness of the fall are constant, but the length of the curve will depend upon the time taken by the palate to reach its highest elevation and the time it is sustained in that position before it falls to the position of rest.[1]

The tracing of the motion of the palate in the first act of deglutition is found to vary slightly from the above when the act of swallowing is completed (Fig. 3). This difference is expressed in the tracing

Fig. 3.

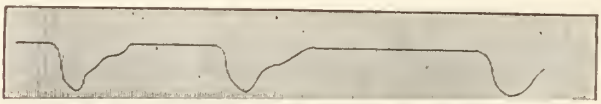


Fig. 3.—The tracing of the act of deglutition.

in a shorter curve of elevation, and a very gradual instead of a precipitous descent.

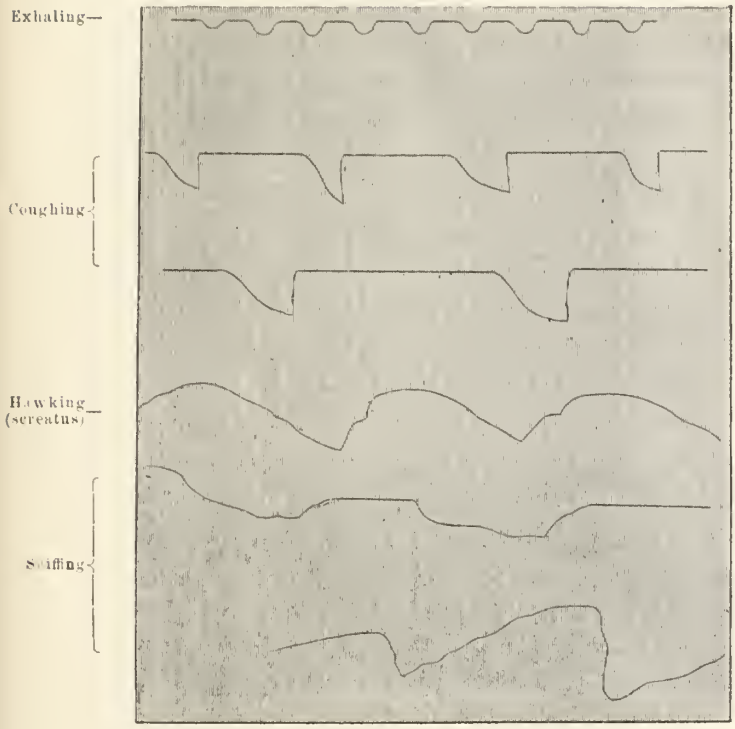
The tracings of the acts of "exhaling,"[2] of coughing, of hawking, and of sniffing will be found to be

[1] All tracings are to read from left to right.

[2] By "exhaling" is meant the sound without voice which is made by suddenly depressing the palate from a moderately elevated position (the mouth being closed), and by driving the air out through the nostrils. It is a sound habitual with some persons who suffer from catarrh.

sufficiently distinct by examination of the curves of Fig. 4.

Fig. 4.



The outlines, as a rule, are assumed to be due to the upper surface of the soft palate striking the end of the rod as it lies within the naso-pharynx. But it is well to remember that the rod may be pushed from right to left or from left to right in a *horizontal* direction by the contraction of the two levator palati muscles;[1] for the elevation of the palate is dependent upon

[1] The motions of the levator muscles can easily be seen by direct inspection from in front, as has been shown by Zaufal (see p. 172) and by Hilton (ibid.) from above.

the force exerted by these muscles, and if the rod be in the way of one of them it will be pushed to the median side and to a point nearer the centre of the naso-pharynx than it occupied prior to the time of contraction. If the rod be thrust through the right nostril it will be moved from left to right; if it be thrust through the left nostril it will be moved from right to left. These curves are best recorded by placing the kymographion-cylinder in a horizontal position.

The following cut exhibits a few of the lateral curves, so that an opportunity is afforded of contrasting them with the vertical curves.

Fig. 5.

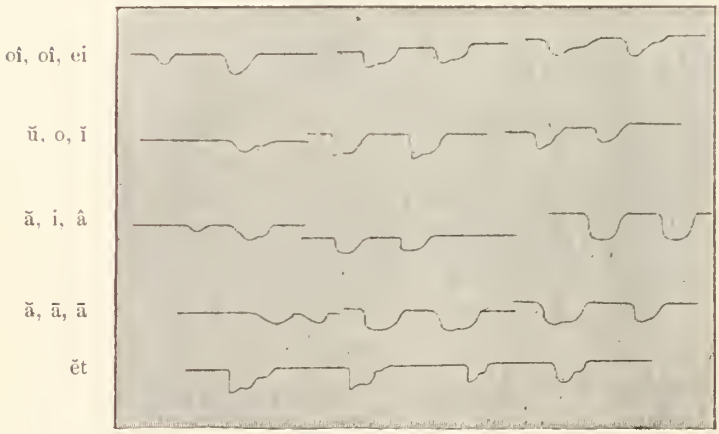


Fig. 5.—A number of palate movements recorded by the lever upon the horizontal cylinder of the kymographion.

The correlation between the two kinds of curves is sufficiently exact to permit either the one or the other to be used, and since it is convenient to retain the

cylinder in a vertical position the tracings will be assumed in this paper to be made with the upright cylinder unless it is otherwise stated.

In making the tracings in either of the positions the head must be carefully supported. A dentist's head-rest, such as is sold by the S. S. White Dental Manufacturing Company, answers an admirable purpose.[1] Should it at any time be found necessary to estimate the amount of variation in any curve due to the motion of the head, a piece of wire attached to the head-band may be made to touch the cylinder a short distance above the position of the index on the lever.[2]

Inasmuch as it is desirable to have a name by which the instrument can be designated I would propose for it the term *palate-myograph.* In an exact sense it furnishes the basis upon which the motions of the levator palati muscles (and through these structures the motions of the soft palate as well) can be recorded, and is hence a *myographion* of a particular pair of muscles whose general function is already known.

Literature of the methods which have been proposed to record the motions of the soft palate and pharyngeal mechanisms generally.—The motions of the soft palate have been studied in three ways: 1st, by direct observation; 2d, by the modification exerted by the

[1] I desire to return acknowledgments to Dr. Jas. W. White, President of the company, for assistance kindly rendered in carrying out the plan of these researches.

[2] I am indebted to my friend, Dr. N. A. Randolph, for this suggestion. In a few tracings, motions of the head are evident, see the tracing of sniffing and the first series of Fig. 5, and in Figs. 23, 37, and 43.

palate on the air of expiration; 3d, by the degrees of force exerted by the muscles themselves.

Methods of Inspection.—These include the observation of J. Hilton,[1] who, in a case of acquired defect of the face, due to the former presence of an osseous tumor, describes the "position of the palate during the formation of letters and words" as follows:—

"Complete utterance occurs only during expiration; and whilst repeating the alphabet the soft palate rises at the beginning and again descends at the termination of each letter or expiration; the sides of the pharynx also slightly approximate. The louder the voice, the more apparent are these actions in the palate and the pharynx. The extent of this adaptation in the ordinary voice resembles that which occurs in the mildest oral expiration; with this difference only that the palate is rather more steady in the process of articulation or formation of the letter than in simple expiration.

"The articulation of each of the vowels and the letter Y produces about the same extent of elevation of the palate. . . . In the formation of the letters H, M, and N, the soft palate is employed actively, and especially so in the letter M."—Schuh[2] has recorded a somewhat similar case.—The motions of the salpingo-palatal fold, according to E. Zaufal,[3] are most pronounced in the letter *i* and in *e* (German), but less well marked in *o* and *u*, and weakest in *m* and *n*.—In progressive facial hemiatrophy Eulenberg found

[1] Guy's Hosp. Rep., i. 1836, 504.

[2] Wiener Med. Wochenschr., 1858; see Med. Times and Gaz. xix. 1859, 357.

[3] Archiv für Ohrenheilkunde, 1875, ix. 137.

the soft palate involved as well as the region termed by Grusset[1] (in quoting Eulenberg) "peri-laryngeal." The letter *r* together with other letters was pronounced with difficulty.—Duchenne[2] has studied the effects of electrical stimulation of the muscles of the palate.—Lennox Browne and Emil Behnke[3] have examined the shapes of the soft palate from the oral aspects, and have recorded their appearances by photography.

Of the methods of recording by the modification in the outgoing of air upon a flame or tambour, reference may be made to the researches of König and Hensen.[4]

A. Gentilli[5] has measured the force of the expired air which passed out of the nose in the formation of the sounds *m* and *n* by placing in front of the nostril a disk or fan upon which the expired air impinged. Accessories were attached thereto by means of which tracings were made upon a recording surface.

Among the methods dependent upon the degrees of force exerted by the palatal muscles may be mentioned that of Arloing and Carlet,[6] who placed in the mouth of a horse compressible flasks filled with

[1] Traité Pratique des Maladies du Système Nerveux, 1881, 627.

[2] Selections from Clinical Studies, Trans. in New Sydenham Soc., Series, 1883, 353.

[3] Voice, Song, and Speech, London, 1883, fig. 215.

[4] For general account and literature, see P. Grutzner in Hermann's Handbuch der Physiologie, I., Bd. II., Theil, 1879, 185–189. See, also, C. Blake, Archives of Otology, vii.

[5] The Glossograph; see abstract by C. Blake in Amer. Journ. Otology, iv. 1882, 193.

[6] Comptes Rendus, 1874 (Nov. 2).

water, which were in communication with a flexible tube, which in turn was united with a manometer.

It will be seen that no attempt appears to have been made to record the degrees of elevation of the palate. Marey[1] declares that any method of exploration of the palate by direct means by which the movements can be computed would be difficult, but makes no suggestion how the difficulties can be overcome.

I will now proceed to briefly analyze the tracings made by the palate-myograph in a variety of palate-motions in my own throat, in order to indicate the uses to which the method here proposed may be put. These descriptions will be placed under the following heads:—

Vowel-Curves.
Consonant-Curves.
Syllables ending in Vowels and those ending in Consonants contrasted.
Word-Curves.
Test-Phrases.
Variation.
The presumed Order of Development of the Palate-Curves.
Inspiritæ.
Negations.

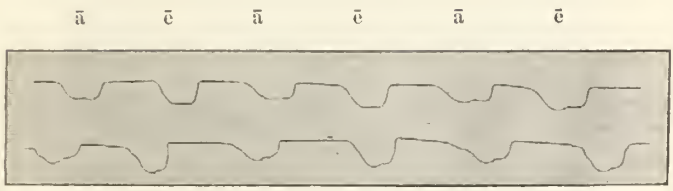
The Vowel Curves.—The lever is found to descend to the most pronounced degree in pronunciation of the

[1] "Autant il serait difficile d'explorer d'une manière directe les mouvements du voile du palais, autant il est facile de siqualer ces mouvements d'apres l'echappement d'air qui en est la consequence." La Methode Graphique, etc., Paris, 1878. 396.

vowel ē. Next in order to ē may be ranged ā. In Fig. 6 a comparison between these two sounds is shown.

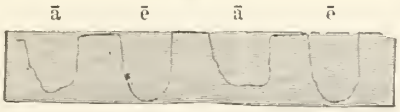
Fig. 6.

1st Series.



2d Series.

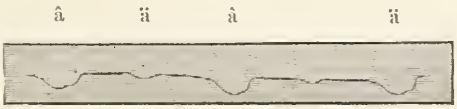
3d Series.



It will be seen that while a slight variation is detected between the curve of the same sound, when made a number of times in the same sitting, that the general character of each curve is distinct. In the third line the exaggerated character of the curve is to be ascribed to the rod having been thrust too far back.

So in Fig. 7, where *â* (as in awe), and *ä* (as in father) are contrasted.

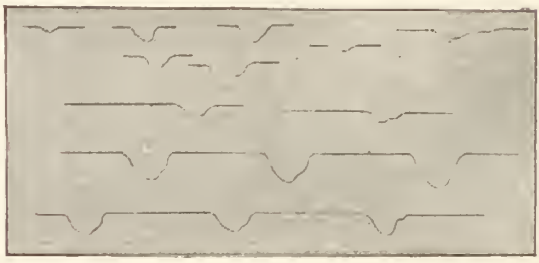
Fig. 7.



The ä-sound of *r* is difficult to render since the palate lies so far below the plane of the rod in making

this sound. These curves are found to be subject to considerable variation.

Fig. 8.



Variants of the sound of *r*.

Among other sounds of the vowels may be mentioned *ë* (as in "*fern*"), *ȧ* (as in "*ask*). This is illustrated in (Fig. 9).

Fig. 9.

ë ë ë ë ë

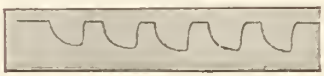


Fig. 10.

ȧ·k ȧ·k ȧ ȧ ȧ ȧ

In Fig. 10 the first two tracings represent the entire word "ȧsk," and the remaining tracings the sound of *ȧ* in the same word.

In Fig. 11 the curves of the sounds of ă and ĕ are contrasted.

Fig. 11.

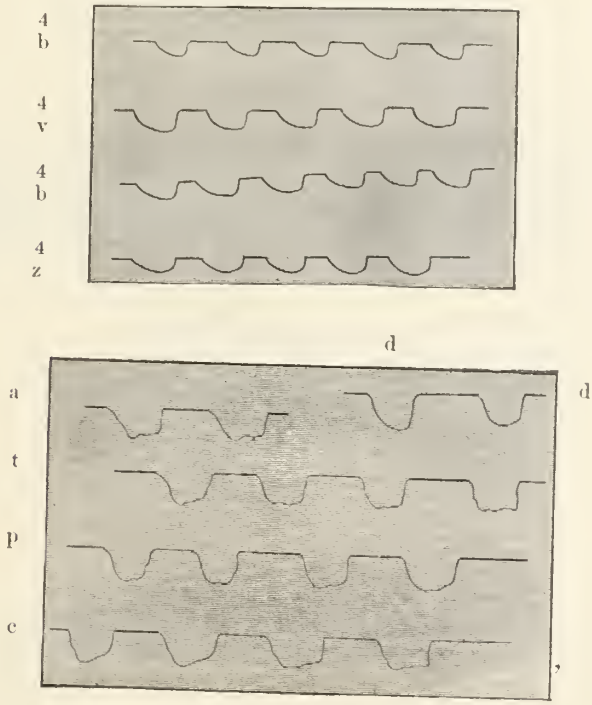
ă ĕ ă ĕ

In Fig. 12 the curves of ŭ and ȯ and ŏ (as in *hot*), and ôô (as in *food*) are contrasted.

Fig. 12.

The *Consonant Curves.*—The tracings of the consonants will resemble those of the vowels more or less exactly according to the quality of the vowel sound entering into the consonant. Thus in Fig. 13 are

Fig. 13.



seen the value of the curve of *b*, *v*, and *z*, based upon the curve of *ē* (Fig. 6).[1]

In Fig. 14 the curves of the consonants *j* and *k* based on *ā* are presented.

Fig. 14.

In Fig. 15 the curves of *f* and *l* are seen based upon ê.

Fig. 15.

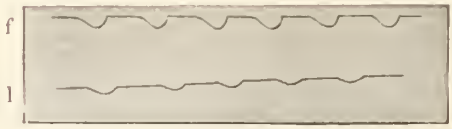
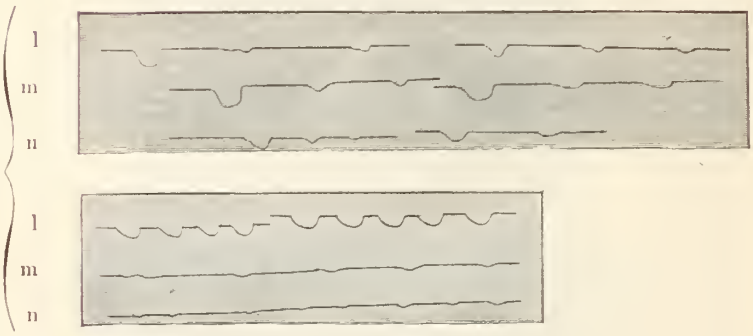


Fig. 16.



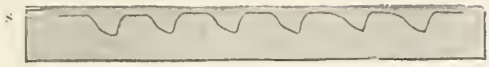
In Fig. 16 a contrast of the letter *ê* in *l*, *m*, and *n*[2] is given.

[1] The variations in the curves, and their limitations, are discussed on pages 185, 191.

[2] The results here recorded agree with those of Zaufal, but differ from those of Hilton see (p. 172), who found the motions of the palate especially marked

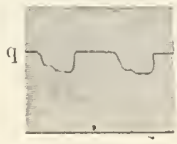
In Fig. 17 the curve of *ê* in *s* is figured in a single group of variants.

Fig. 17.



In Fig. 18 the curve of the letter *ū* in the consonant *q* is figured.

Fig. 18.

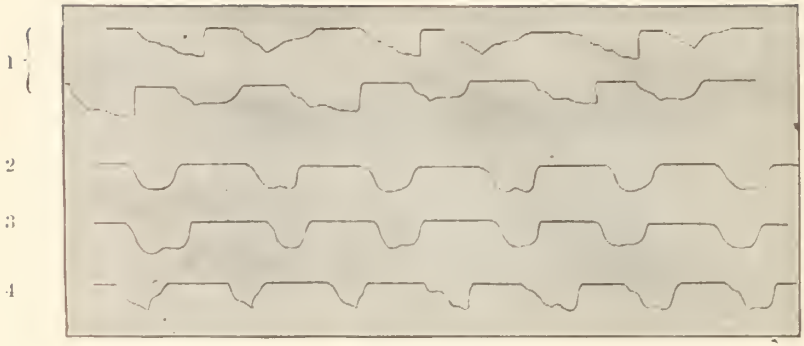


The Syllables ending in Vowels and those ending in Consonants contrasted.—Since words are purely of conventional character it is evident that the division of the curves into the phonetic values of vowels and consonants, and the arbitrary values assigned to the word-curve is one of convenience only. A series of curves is herewith presented (Fig. 19) which contrast the vowel sounds ending on consonants with the consonantal sounds ending on vowels. It is interesting to note that the mechanism of the palate is distinct in the two instances.

The *Word-curves.*—For practical purposes it is convenient to use the curves made by the pronunciation of entire words instead of the separate value of vowels

in the pronunciation of the letters *m* and *n*. It must be remembered that this observer looked down upon the palate. The palate would appear to move in the formation of the letters, but the palate is not sufficiently raised either to the degree sufficient to contract the levators or to raise the velum to a point at which a horizontal lever thrust into the naso-pharynx is raised.

Fig. 19.



1 âd, dâ, âd, dâ, 3 t, čt, t, čt
2 d, čd, d, čd, 4 dă, ăd

or consonants. The analysis of these word-curves show that there are four kinds—the single, the double, the multiple, and the composite.

Of the *single word-curves* the following (Fig. 20) may be taken as examples.

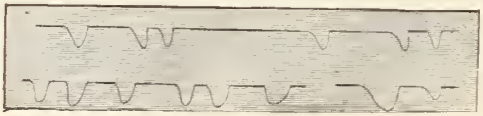
Fig. 20.

Of the *double curves* the following (Fig. 21) may be taken as examples.

Fig. 21.

Sin, sins; tin, tins

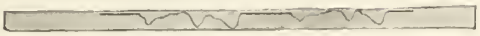
Sins, sin; sins, sin



sins

Fig. 22 represents the curves belonging to the letter w, which, of course, has the value when pronounced of "double yū."

Fig. 22.

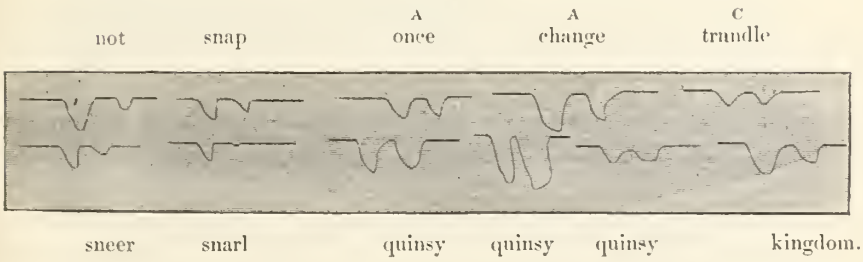
w 

In Fig. 23 a *multiple word-curve* is seen in the word "kingdom." See, also, Fig. 24.

Fig. 23.

Kingdom, kingdoms

Fig. 24 [1]

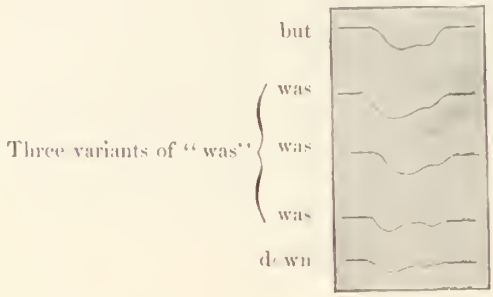


A series of double curves is represented in Fig. 24 showing the combination of curves more or less resembling one another. In each instance the palate comes to a state of rest for an appreciable interval before a second time descending. Three variants of "quinsy" are presented, for it was found to vary in Mr. Cohen and myself. The curves with the largest excursus was evidently influenced by the levator palati-muscle. The curves of "kingdom" are repeated in Fig. 23.

[1] The words marked "A" and "C" indicate the names of the recorders, Allen and Cohen.

A series of separate word-curves from the foregoing is represented in Fig. 25.

Fig. 25.



This group is intermediate between that of the single and the double curves. They all belong to words of a single syllable, yet are distinguished from those seen in Fig. 25 by showing but a slight disposition on the part of the palate to descend before it a second time ascends.

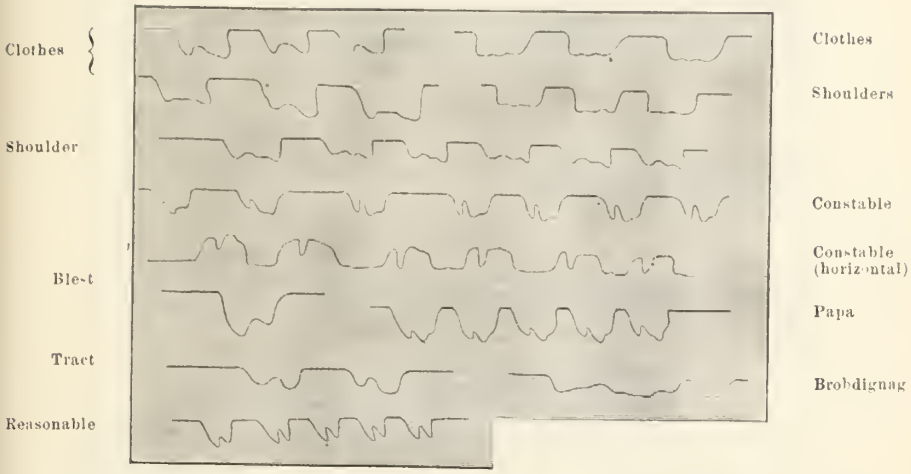
A second series of the same is seen in Fig. 26.

Fig. 26.

A third series, showing the greatest amount of secondary curving before the palate falls to rest, is seen in Fig. 27.

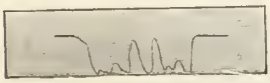
Test-phrases.—Since much of the interest which will obtain in the use of the instrument here described is clinical, it is likely that the curves described at the time of the utterance of a phrase will have the same value as those correlating to phonetic values or

Fig. 27.



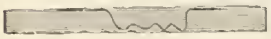
to single words. A few phrases are herewith appended in illustration of this subject. (Figs. 28–33.) It is evident the palate has fewer difficulties to overcome during the pronunciation of the legend of Fig. 30 than that of any of the other legends. Fig. 33 is interesting in showing how exactly the curves of the words "*to*" and "*be*" repeat themselves in the deliberately pronounced phrase "*to be or not to be.*"

Fig. 28.



An empty bag cannot stand upright.

Fig. 29.

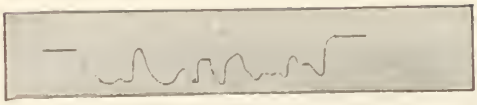


Honesty is the best policy.

Fig. 30.

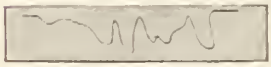
A bird in the hand is worth two in the bush.

Fig. 31.



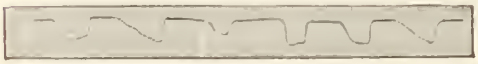
Early to bed, early to rise makes a man healthy, wealthy, and wise.

Fig. 32.



A rolling stone gathers no moss.

Fig. 33.



To be or not to be.

to be or not to be

The question that has often been asked why words are pronounced in a manner different from that which would be premised from the spelling, and why the street pedlers of east-off clothing persist in crying "old clo" when "old clothes" is known by them to be the correct pronunciation, may receive an answer when the curves of the word as really pronounced are compared to the curves of the word as they should be pronounced if every syllable were given its full value. Such words as Magdalen, Ispahan, Treheran, and Beauchamp may serve as examples. Fig. 34

Fig. 34.

Beecham (repeated.)

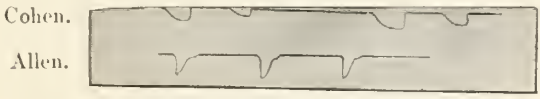
Beauchamp.

illustrates the difference between Beauchamp and "Beecham."

Variation.—It is not to be supposed, however, that the palate will make the same curves for the same sounds in all individuals. A margin for individual variation must be made if any conclusion can be drawn from the manner in which my assistant, Mr. Cohen, will form certain curves as contrasted to those of other observers, including myself.

Thus Mr. Cohen in pronouncing "*and*" secures two curves (see Fig. 35), whereas in my own throat but a single curve of a different shape results.[1]

Fig. 35.



Variations in "and" in two individuals.

The character of the curve is here of less importance than the number, for in a separate series of studies of "*and*" in my own throat (see Fig. 36) I have

Fig. 36.

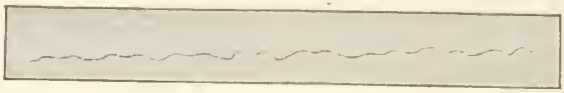
Variations in "and" in the same individual.

secured two distinct types of curves from this word but never more than one curve for each word. The difference in the shapes of the curves may be attributed to the difference in the position of the rod with respect to the palate during the different sittings.

[1] The first two of the first series of lines have unfortunately been mutilated in Fig. 35. The last two (placed to the right of the cut) are intact.

The presumed Order of Development of the Palate-Curves.—The palate-myograph may prove useful, it is thought, in studying the times at which the different motions of the palate in phonation came into play. If the articulate sounds made by a child be imitated when the palate-myograph is in position it will be seen that the sound of mamma is the simplest of them all. I have under this heading simply contrasted the curves of "*mâmmâ*" and "*pâpâ*" (see Fig. 27), to show that it is probable that the reason for the sound "*mâmmâ*" (Fig. 37) being first used by the infant is that the palate is moved least in producing the sound.

Fig. 37.



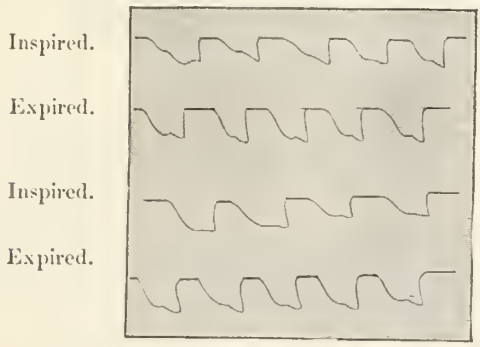
The curves of "mamma."

The Inspiritæ.—Since the sounds of speech for the most part are made upon the out-going breath the movements of the soft palate in assisting in their formation will be co-related to the respiratory act. The palatal mechanism might be compared to a second sphincter placed between the laryngeal sphincter and the lips. When the proposition is differently stated and the speech sounds are known to be found not on the out-going but on the in-going air, it has been thought worth while to notice if the palate mechanism is in any way modified on account of the air passing through the pharynx. No sound of the character just named is normal to English or indeed to any of the European languages. Dr. D. G. Brinton, who first called my attention to the subject, informs me that in

the Bushman dialect as many as four of the inspiritæ (as they are termed) can be enumerated. The Esquimaux have at least one, the "cluck," and the Arabians some.

In experimenting with the inspiritæ difficulty was experienced in the unpleasant drying of the vocal cord attending the act of articulating upon the ingoing breath. I have contented myself to reproduce the "cluck" sound (Fig. 38) both on inspiration

Fig. 38.



The curves of "cluck."

and on expiration in order that the two can be contrasted; it will be noticed that the difference between the two sets of curves is very slight if any can be said to exist.

Fig. 39.

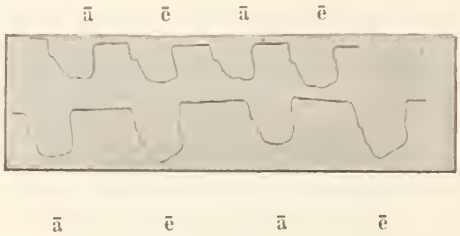
In Fig. 39 the curves of the vowel sounds *ā*, *ē*, *ī*, *ō*, *ū* are represented as formed in inspiration.[1]

[1] Dr. Berens.

The inspiritæ of low pitch cause larger curves to be described than those of high pitch.

The amount of elevation of the soft palate in enunciation is independent or nearly so both of volume and of pitch. In Fig. 40 the vowels *ā* and *ē* are

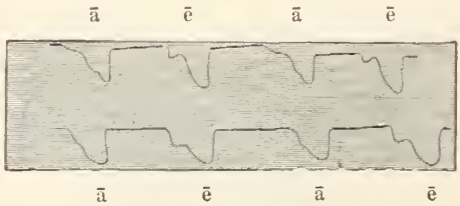
Fig. 40.



contrasted in the head and chest registers. The curves show some influence from the action of the levator palati muscles, but, with the exception of being a little too deep, are normal curves for these sounds. It will be seen that there is little or no effect of register upon the formation of these curves.

In two series the following falsetto notes (Fig. 41) were formed on the same vowel sounds. A more

Fig. 41.



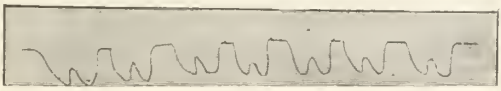
marked difference is here observed between the curves. The palate appears to be tremulous, and makes two undulations in the curves of *ē*. This record is from

my own throat. I have no vocal training, and it is probable that the palate of a vocalist may give different results.

Negations.—While it has been seen that the palate moves in every consonantal and vowel sound, it nevertheless does not assist in the formation of many sounds. Thus the motions of the palate are the same in the word "*souf*" as in "*south*" (Fig. 42), and

Fig. 42.

"Souf" and south.



in "*nuffing*" as in "*nothing*" (Fig. 43). The difficulty the negro acknowledges in pronouncing

Fig. 43.

"Nuffing" and nothing.

"*south*" and "*nothing*" (converting the words into "*souf*" and "*nuffing*") lies in the relations of the tip of the tongue to the teeth, hard palate, and lips (in a word to his prognathism) and not to any peculiarities of the soft palate.

In like manner those persons who pronounce *what* as though spelt "*vat*" (Fig. 44) make precisely the

Fig. 44.

Whât "Vât."

same palate curves for the two sounds. The curves, indeed, are those of *â* with the terminal consonant *t*, and the distinction between the *wh* and the *v* are in the lips and teeth.

The distinctions between *that* and "*lat*" (Fig. 45) are of the same character. Most children are slow in

Fig. 45.
Lăt and thăt.

procuring the "*th*" sound but acquire the "*l*" sound easily. The same remark applies to the Chinese.

The same comments are not applicable t the distinction between *well* and "*vel*" (Fig. 46); for a

Fig. 46.
Wĕll and "vĕll."

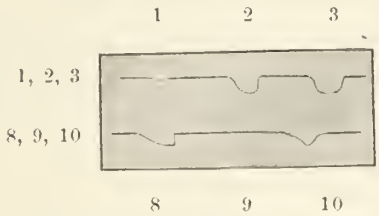
simple curve is seen to be recorded for "*well*," but a sinuate curve for "*vell*."

In Fig. 47 the curve of the words *one*, *two*, *three*, *eight*, *nine*, *ten* are recorded with the object of showing that the word "one" makes scarcely any curve, the word "nine" none.

Remarks.—Such in brief is an outline of this new method. The fact that the soft palate is raised in articulation of all articulate sounds, that it is raised in the acts of swallowing, of coughing, of hawking,

can be readily demonstrated. The length of time at which the palate remains elevated, and the duration of the time of ascent and descent, can also be easily

Fig. 47



The curves of "one, two, three, eight, nine, ten."

ascertained. The palate is seen to be raised once only for some words; twice for others, and three times for others. The numbers of these motions are invariable within a narrow range of individual variation. The size of the curves, however, is not fixed owing to the difficulty of always reaching precisely the same spot of the broad upper surface of the soft palate. But the curves, whether deep or shallow, hold the same proportions one to another, as is seen in the different series of Fig. 6, and in the various curves of the letter *l* in Fig. 16, and of the letter *s* in Fig 17. By proper care in freeing the rod from contact with the salpingo-palatal fold, and in placing the rod about the centre of the palate, the exaggeration of curve can be in great measure prevented. It is evident that variation in the size of the bulb at the pharyngeal end of the rod will cause corresponding variations in the size of the curves. Hence it is recommended to preserve the form and size of the bulb described on p. 167, and to keep it free from mucus.

Even if the same spot could at all times be reached, would it be reasonable to expect the curves to have

uniform values for the same sound in different individuals, or in the same individual at different times, or even in the same individual at different times in a single sitting? The soft palate is but partially under the control of the will, and this control varies in different persons. The palate, as other muscular structures, is subject to fatigue, or may act irregularly from prolonged contact with the metallic rod. Again, the personal element that enters into the variation in the transit of volitional impulses must be as appreciable in the case of the soft palate as any other muscular apparatus in the economy.

On the whole, it may be said that the sources of inconstancy of the curves are not sufficient to invalidate the claim of accuracy for the method.

The palate-myograph may be of use in studying the mechanism of the soft palate, in disease as well as in health. It is evident that in paralysis of the palate the motions would be absent, and that by this method a means of detection of this condition is available. It may probably prove of use in studying stammering, and in determining the degree of degeneration of the levator-palati muscles in progressive dry aural catarrh.

As the soft palate ascends, the oral surface becomes concave.[1] This concavity is occupied by the convex

[1] It would be an ungracious act to examine critically the figures in the numerous works upon the throat and mouth in which the palate is represented, as seen in sagittal (anterio-posterior) section during the formation of the vowels and consonants; without exception they are based upon erroneous conceptions of the movements of the velum in speech.

dorsum of the tongue in some sounds as in the consonant quantities, *kā* and *qu*, etc., but may be free from the tongue in other sounds, as that of *o*. The elevation of the palate is not the result of the pushing up of the relaxed velum by the lingual basi-dorsum, but of the active elevation by means of its own muscles. The correlations of the tongue with the palate are, as a rule, notwithstanding, exact enough to warrant careful comparison of the two factors in the mechanism of speech.

The palate-myograph may be employed in the study of phonetics, together with the different forms of glossographs as an accessory, if the premises of the preceding paragraph are correct.

On the action of palato-pharyngeal and azygos muscles little can be here said. I have made a number of observations with a long curved rod passed through the nose, and have ascertained that the approximation of the two palato-pharyngei may be recorded, but the retention of the rod in this position is painful, excites a little bleeding, and soon throws the pharynx into an excited state.

The plan of holding the rod in any desired position by the flexible wire and head band, can be utilized in keeping instruments in position such as the snare, the syringe, etc., so that the head-band may be employed as an accessory in the removal of growths from the naso-pharynx and the nose.[1]

[1] I desire to express my acknowledgments to Dr. N. A. Randolph, Dr. C. Berens, and Mr. N. Cohen, for assistance rendered during the course of the investigation.

The foregoing account is designed to indicate the medical uses of this method of studying palatal motions. The method may have a wider range of application than the one delineated; and it may be well to suggest at this place that, in the judgment of competent critics, it may be made available for the comparative study of language, for the instruction of the deaf, and for the formation of a system of logography or short-hand writing.

I have thought it best, however, to confine my text to the limits which naturally define the horizon of medical observation, rather than delay publication by awaiting the results of laborious efforts needed to extend these limits over a wider and untried field.

A STUDY OF THE NUTRITIVE VALUE OF BRANNY FOODS.

By

N. A. RANDOLPH, M.D.,

LECTURER ON PHYSIOLOGY, UNIVERSITY OF PENNSYLVANIA,

AND

A. E. ROUSSEL, M.D.,

LATE RESIDENT PHYSICIAN AT THE PHILADELPHIA HOSPITAL.

[Read June 4, 1884.]

FROM an economic standpoint the question of the nutritive value of bran is one of great importance, for the removal of this portion of the wheat implies a loss of from 17 to 20 per cent. in the weight of the grain. In spite of this loss, which necessarily renders white bread more expensive than that made from whole wheat flour, even the poorest inhabitants of most civilized countries where bread is not the staple food, insist upon eating the bread made from the finer grades of flour. A tendency so widespread as this would apparently indicate the unconscious summation of the experiences of many generations, and go far toward proving the propriety of such a selection.

The use of flour representing the entire wheat grain has, however, been long and ably advocated; the reasons given for the retention of bran being that its removal entails the loss of:—

I. "Nutritive salts" (Nährsalze of Liebig).

II. Carbohydrates.

III. Proteids, notably gluten.

The facts, also, that branny foods in common with many others will spur an atonic bowel to activity, give due bulk to its contents, and induce the passage of stools of the normal or feculent consistency are noteworthy, but their further consideration is beyond the limits of the present paper. The other reasons for the retention of bran in wheat flour will be discussed seriatim.

I. The fact that fine flour contains a much smaller percentage of salts than does either bran or the whole wheat—a fact evidenced by the relatively small amount of ash which it yields, forms the basis of the theory of Liebig,[1] that in the removal of bran nutritive salts of value are lost. The investigations of Meyer[2] and Forster[3] are often cited as showing that after the removal of bran, these salts are still present in quantity sufficient for the needs of the economy.

Our experiments upon young pigs, described further on, show that although survival is quite possible upon an exclusive diet of bread from white flour, growth is much more active upon a diet of bread containing a greater amount of inorganic matter. It is possible that Liebig's estimate of the needful amount of inorganic matters was too high, but it is equally noteworthy that there is a tendency on the part of late writers to give insufficient prominence to the

[1] Chemische Briefe, 1851.

[2] Zeitschrift f. Biologie, vol. vii. p. 33.

[3] Ibid., vol. ix. pp. 293–380.

importance of these elements of food. It may not be out of place here to mention a striking illustration of the absolute necessity for inorganic salts in the fluids of the economy, as recorded by Dr. S. Ringer.[1] This observer found that while minnows were kept in ordinary tap water they would live for weeks unfed. When, however, they were placed in distilled water they died on an average in four hours and a half. Further, that in a rude imitation of spring water, made by the addition to distilled water of potassium and calcium chlorides, and of sodium bicarbonate, the fish lived on an average about two weeks. Study of the factors in the experiments showed that death was due to a diminution of salts in the economy of the fish. That such diminution, even when very slight, could result fatally, was shown by an analysis of the distilled water after the death of the fish; traces only of inorganic matter being found.

II. The loss of carbohydrates involved in the removal of bran, appears at first sight not inconsiderable, as it amounts to about 20 per cent. of the carbohydrates present in the entire grain. The members of this group represented in bran are starch and cellulose. The former is present in extremely small amount, while the latter, as has been proven by the experiments of Donders,[2] Mulder[3] and Poggiale[4] is digestible in any noteworthy degree[5] by the herbivora only.

[1] Journal of Physiology, vol. iv., No. vi., Feb. 1884, in the appended Proc. Physiol. Soc., session Dec. 13, 1883.

[2] Nederl, Lancet, vol. vi. pp. 227, 244.

[3] Physiologische Chemie, p. 1024.

[4] Comptes Rendus, vol. xxxvii. p. 173.

[5] See, also, Weiske (Centralblatt, No. 26, 1870), who finds that a small percentage of cellulose, especially when cooked, is dissolved in the human digestive tract.

The observer last named subjected a given weight of dry bran to the successive actual digestions of two dogs and one hen, and, thereafter, was able to recover over 65 per cent. of its non-nitrogenous constituents. The loss in cellulose was probably much less than that here indicated, for we have found that during the maceration of bran in the digestive tract, certain portions become detached from the main flake, and are with the greatest difficulty recovered.

III. Wheat bran contains a considerable but varying proportion of nitrogenous compounds averaging however about 14 per cent.[1] This fact has permitted the continued existence of two widely credited assumptions: (*a*) That this nitrogen exists in albuminoid combination, or, in other words, is in a nutritious form; and (*b*) that the proteid matter of wheat is contained almost exclusively in specific cortical cells of the grain—the so-called "gluten cells."

(*a*) Nearly all the existing estimates of the proportion of proteids in food stuffs are based upon the hypothesis that all of the contained nitrogen is present in some albuminoid combination. The percentage of nitrogen in a given food is therefore ascertained, multiplied usually by either 6.5 (Payen) or 6.33 (Ritthausen) and the result recorded as the percentage of proteid matter. It has lately been conclusively proven that nitrogen in non-albuminoid combination, *i. e.*, in compounds not capable of affording nourishment to

[1] Dempwolf, Ann. d. Chem. u. Pharm., vol. cxl. p. 343. His figures, of interest here, are as follows: The amount of nitrogenous matter in the whole wheat was 14.35 per cent. The amount varied in the different grades of white flour from 11.01 to 15.56 per cent. The nitrogenous matter of the two grades of bran made from this wheat was respectively 13.93 and 14.06 per cent.

any higher organisms, is present in many food-stuffs, and especially in those of vegetable origin. As a case in point may be mentioned the analyses of Wigner,[1] in which it is shown that of the total nitrogenous matter of the entire wheat grain, 87.9 per cent. is coagulable, *i. e.*, distinctively proteid. Of the bran only 42.4 per cent. of its nitrogenous compounds are coagulable, whereas, in the flour, 89.7 per cent. of these bodies come under the head of true proteids. Yet more marked instances of the inaccuracies attending the ordinary methods of estimating proteids have become evident in the course of researches by Schulze and Barbieri,[2] who find that of the entire nitrogen of the potato but 56.2 per cent. enters into the composition of albuminoid matter, while in the fodder beet only 20 per cent. of its contained nitrogen is thus combined, the remaining 80 per cent. aiding in the formation of amides, nitrates, and ammonia. It is evident from these facts that estimates of the nutritive value of branny and other foods, based upon the percentage of nitrogen present, must be received with caution.

(*b*) The term "gluten cell" is, through a widespread misapprehension, applied to the cells constituting the fourth layer (Parkes) of the wheat grain. These cellular elements exist usually in a single stratum, as irregularly euboidal bodies in each of which, surrounded by a dense and laminated cellulose wall, is seen the semi-opaque granular contents. Upon the addition of reagents, especially in the form of caustic alkaline solutions, there is almost

[1] Der œsterr. ungar. Müller, 1879, p. 52.

[2] Quoted by Voit, Hermann's, Hdb. d. Physiol., vol. vi. p. 462.

constantly noticeable a differentiation of the contents strongly suggesting the presence of a nucleus. Under these conditions, also, a coalescence of many of the individual granules forming the contents occurs with the formation of several highly refractive spheroidal bodies, an appearance which has led Payen (as quoted by Dr. Richardson) to use the name oléifères as a synonym for the cellular constituents of the fourth coat. The hypothesis that the cells of this layer are the chief gluten bearers of the wheat grain is usually attributed to Donders.[1] The return of bran to flour was at about the same period also advocated by Millon and Mége Mouriès.[2]

From this time on, with but few dissenting voices, the "gluten cell" has been generally spoken of as the index of the nutritive nitrogenous matter[3] of the

[1] Nederl, Lancet, iv. 739; vi. 227, 244. Third series, vol. i. 377.

[2] Comptes Rendus, vol. xliv. p. 47.

[3] By general consent the albuminoids of the wheat grain are grouped together as gluten, which is, however, further separable into gluten-fibrin, gluten-casein, gliadin, and mucedin, proteid bodies practically equal in nutritive value, but differing in certain physical properties, notably that of solubility. It must therefore be borne in mind that in all methods of separating gluten from the other constituents of the grain, its (relatively small) soluble portion is removed with the starch, and that any estimate of the quantity of gluten based upon such methods will probably be below rather than above the actual amount. Ritthausen (Die Eiweiss-Körper der Getreidearten, 1872) believes that a certain amount of true albumen should be included with the constituents of gluten just mentioned. An observation of Denis (Mémoire sur le sang, 1859) confirmed by Hoppe-Seyler (Med. Chem. Unters. 1867) and Weyl (Ber. d. deut. Chem. Ges., xiii. 10. 1880) demonstrates that a portion of the proteids of the cereals exists in the form of a globulin. Thus, the observer last named has shown that in wheat flour treated with a 15 per cent. solution of sodium chloride, no formation of gluten occurs. We have found that bran, when macerated in 15 per cent. salt solution, yields a considerable amount of proteid matter precipitable by nitric and picric acids. We incline to believe, however, that this is not a true albumen. (See Vines, *Journal of Physiology*, vol. iii. p. 93.)

wheat grain, while the central portion included within this layer, and constituting fully 80 per cent. of the grain, has been popularly regarded as being made up almost exclusively of cellulose and starch, and attempts have even been made to estimate the nutritive value of certain cereal food-stuffs by a microscopical determination of the proportion of "gluten cells" present.[1]

The manifest impropriety of such methods has of late been strongly emphasized by Prof. Richardson of this city, and Prof. Leeds of Hoboken. The credit of the first disproof of the exclusive limitation of gluten to the cells of the fourth layer, is probably due to Schenk,[2] who treated sections of wheat grain with Millon's reagent, a pink coloration of the endosperm resulting. This coloration was most vivid at the periphery, indicating a gradual condensation of the proteid constituents of the grain as the cortex was approached. The same writer found "no coloration of the 'gluten cells' as a result of this reagent," an observation which we cannot confirm; for, apart from the readily demonstrable slight coloration of the contents of "gluten cells" after the application of Millon's reagent, it is more than difficult to conceive a cell, however specialized, which shall exhibit no proteid matter as a portion of its contents. Schenk also noted in artificial gastric digestions of sections of wheat, that the starch granules which (to a greater extent) fill the cells of the central portion of the grain, became detached, and from this fact deduced the just proposition that the starch granules lay imbedded in some albuminoid substance. In a study of the dis-

[1] E. Cutter, M.D., Galliard's Med. Journ., Jan. 1882.

[2] Anat.-Physiol. Untersuch., p. 32, Wien, 1872.

tribution of gluten within the wheat grain,[1] the senior writer has described several methods for the ocular demonstration of gluten, in very considerable amount, in that portion of the grain included within the fourth layer, and entirely independent of the "gluten cells." The methods were as follows:—

If whole wheat grains be macerated in water, to which a few drops of ether have been added to prevent germination, they will in a few days become thoroughly softened, and the contents of each grain may then be squeezed out as a white tenacious mass.

Examination of the remaining bran shows the "gluten cells" undisturbed, closely adhering to the cortical protective layers.

By now carefully washing the white extruded mass, the major part of the starch may be removed; and, upon the addition of a drop of iodine solution, microscopic examination shows numerous networks of fine yellow fibrils, still holding entangled in their meshes many starch granules, colored blue by the iodine.

In carefully washed specimens, the sponge-like networks are seen to retain the outline of the central starch-filled cells, and evidently constitute the protoplasmic matrix in which the starch granules lay. Upon gently teasing such a specimen under a moderate amplification, the fibrils will be seen to become longer and thinner in a manner possible only to viscid and tenacious substances—a class represented in wheat by gluten alone.

An eminently satisfactory proof of the proteid nature of these central networks may be obtained by

[1] Randolph, Proc. Acad. Nat. Sci. Phila., Dec. 11, 1883, p. 308.

heating the specimen in the solution of acid nitrate of mercury (Millon's reagent), when the fibrils will assume the bright pink tint characteristic of albuminoids under this treatment. The results of the application of the xanthoproteic and biuret reactions are equally conclusive, but more care is required in the use of these proteid tests, and the resultant differentiation is not so clear. Reticuli, similar to those above described, but much broken and consequently far smaller, may be seen upon close examination, scattered throughout fine white flour, without the use of any reagent.

In even the thinnest sections of the wheat grain, the gluten of the central portion is always masked by large numbers of starch granules. These may to a large extent be removed by immersing the section for a short time in liquor potassii, with subsequent careful washing. The alkali effects the hydration and partial solution of the starch; but if its application be too long continued, the gluten will also be dissolved. This treatment is well adapted to show the rather dense gluten networks usually found adherent to bran immediately below the fourth layer.

The most satisfactory method of studying the distribution of gluten in sections of wheat, is that of artificial salivary digestion. If the section be gently boiled for a moment to hydrate the starch, then transferred when cool to filtered saliva, and maintained for from half an hour to an hour, at a temperature of about 98° Fahr., all the starch will be dissolved, while the insoluble proteid and other constituents will remain *in situ* and entirely unaltered. The same result may be obtained from a somewhat more prolonged

digestion of the unboiled section. A section of wheat grain thus treated will exhibit throughout its entire central portion close-meshed gluten networks, which become slightly denser towards the cortex of the grain. The proteid character of these reticuli is here, as in the first method, susceptible of microchemical demonstration. Upon the application of Millon's reagent to such a section, a relatively very faint coloration, indicating the presence of albuminoids, is noticeable in the "gluten cells," while the gradual condensation of the gluten of the endosperm, as the fourth layer is approached, is evident even to the unaided eye.

The fact that the gluten networks become denser towards the periphery of the endosperm, together with the presence of non-albuminoid nitrogenous compounds in the perisperm, explains the notable percentage of nitrogen found in bran as ordinarily roughly removed.

The small proportion of albuminoids present in the cells of the fourth layer as evidenced by their feeble response to the proteid tests, together with the very considerable quantity of gluten which we have shown to exist in the central four-fifths of the grain (*i. e.*, the portion lying within the fourth layer) justifies us in the conclusion that by far the major portion of the nutritious nitrogenous matters exist in entire independence of the "gluten cells."

The difficulties which attend the complete isolation of these cells, however, have as yet rendered impossible any accurate estimation of the proportion of their proteid contents. Admitting for the moment that the "gluten cells" contain albuminoids in any note-

worthy amount,[1] there are yet present conditions which seriously affect if they do not entirely nullify the nutritive efficiency of this portion of the grain.

The first of these conditions is the presence of the rough bran scales which, by increasing peristalsis, so hasten the passage of the entire intestinal contents that complete digestion and absorption are prevented. The second is that owing to the dense cellulose walls of the "gluten cells," their contents are practically unaffected by the digestive juices. The fact that the presence of branny scales in the digestive tract prevents the thorough digestion of the intestinal contents and induces the passage of feces containing a considerable excess of undigested nitrogenous matter is fully attested by the observations of Meyer and Rubner.[2] Edward Smith[3] has also closely studied the economic phase of this subject, and reports most unfavorably upon the use of branny foods, stating that the diminished absorption of nutritive matters, entailed by their use, more than counterbalances the (apparent) gain in cheapness. Of interest in this connection is the observation of Fr. Hofmann[4] who noted that the amount of feces passed upon a meat

[1] Apart from the statement of Schenk, above cited, the entire absence of gluten in the cells of the fourth layer has been latterly affirmed by Mége Mouriès, who is quoted by Payen (Substances Alimentaires) to the effect that these cells are "filled with nitrogenous substances of which gluten is not at all one." He finds the cells in question to contain in addition to the salts of magnesium, lime and potash, a peculiar diastatic ferment, cerealin, whose function is the transformation of the starch of the grain into dextrine and glucose for the nourishment of the germinating seed.

[2] Zeitschrift f. Biologie, vol. vii., ibid. xix. 1883, p. 46.

[3] "Foods," 1875, p. 175.

[4] Voit, Sitzgsber. d. bayr. Acad., Dec. 1869.

diet was remarkably increased by the addition of cellulose to the food taken.

The feeble response of the "gluten cell" to reagents and digestive juices has been noted by several observers. Thus Donders[1] states that these bodies are digested by the herbivora but not by dogs or man. Similar results are recorded by Poggiale,[2] and for domestic fowls by Meissner and Flüge.[3] J. Lehmann[4] records the feeding of pigs for thirty-two days on bran which contained almost no flour, with a nearly negative gain in weight, although the bran contained 15.5 per cent. of nitrogenous matters.

The ability of herbivora to digest "gluten cells" and similar bodies is probably due to the relatively powerful amylolytic ferments of their digestive fluids, for it has been demonstrated that pepsin is unable to traverse cellulose.[5] It has also been shown by one of us[6] that the cells of the fourth layer are to all appearance entirely unaffected by prolonged artificial digestions—salivary, gastric, and pancreatic, and further that their contents were but little changed, and their walls in nowise disintegrated by immersion for some days in strong acids and alkalies.

Lately, however, in the course of an admirable paper upon the nutritive relations of gluten, Rubner[7] has stated that although branny foods increase the amount of nitrogen in the feces, fully three-fourths of the nitrogenous matter of bran is digested. In the

[1] Physiologie (German ed.), p. 273.
[2] Comptes Rendus, 1853.
[3] Zeitsch. f. rat. Med., vol. xxxi. p. 185, and vol. xxxvi. p. 184.
[4] Amtsbl. f. d. Handl. u. wer. d. Königr. Sachsen, 1868, No. 2.
[5] Hammersten, Jahresber. d. Thierchemie, vol. iii. p. 207.
[6] Randolph, Proc. Acad. Nat. Science, 1883, p. 311.
[7] Zeitch. f. Biologie, vol. xix. 1883, p. 46.

bran used there was present 4 per cent. of nitrogen, "equalling 25 per cent. albuminoids," while in the bran obtained from the feces of the persons under observation only 0.9 per cent. of nitrogen was obtainable. We hesitate in criticizing the results of so able an observer, but it seems to us that there were two sources of error in this portion of his investigation. In the digestion of bran the free, adherent gluten, which properly belongs to the more central layers, is of course readily dissolved with a consequent reduction in the nitrogen of the bran. Apart from this, however, a loss in nitrogen is to be expected from the diffusion of nitrogenous crystalloids; further, the "gluten cells" become so separated from the true bran, during their maceration in the intestinal contents, so that it is nearly if not quite impossible to recover them.

In order to satisfy ourselves regarding the digestibility of the cells of the fourth coat, we have subjected bran with its adherent "gluten cells" to actual digestion by twelve well-nourished adults, six males and six females. These twelve persons were selected from a larger number by excluding all whose feces exhibited under microscopic examination any inefficiency in the amylolytic and proteolytic digestive ferments as evidenced by the presence of starch or muscle fibre in more than a minimal amount. Sources of error arising from individual peculiarities having been eliminated by the number of persons under observation, and the best conditions for digestion having been obtained, these persons then received daily for three days, in addition to their regular food, one ounce of thoroughly boiled bran. Their feces for the last two days of the treatment were

submitted to close microscopical examination, with results so nearly uniform as not to require tabulation. In every case the number of "gluten cells" present was more than sufficient to render a diagnosis of the food taken a matter of great ease. In two-thirds of the cases no evidences of disintegration of any of the cells could be found upon repeated examination of many fields from each specimen. In four cases a small proportion (less than 10 per cent.) of the numerous cells examined showed evidences of having been affected by the digestive process, the cell contents having become lighter in color and less opaque. If, however, any true digestion of the cells had occurred, it is evident that many of these elements in different stages of disintegration would have been seen.

As a rule, we found that the several layers of the bran presented an appearance, not of having been digested, but simply of having been subjected to prolonged maceration. Thus the three coats of the true bran while entirely unchanged were frequently found separated from each other. We had expected to find the fourth layer closely adherent to the third, as is the case in dry bran, but in the majority of specimens these two coats became separated, and occasionally large sheets of "gluten cells," to all appearances perfectly normal, were seen. As a rule, however, that portion of the fecal mass representing the meal at which bran was taken[1] was found to contain these thick-walled cells in nearly every field.

[1] We did not find it needful to give with the bran any coloring matter to differentiate in the feces the meal at which it was taken, as the scales of bran were always a sufficient index. When requisite, such differentiation may readily be obtained by the method of Cramer (Zeitschr. f. Physiol. Chem., vol. vi. p. 354), or that of Rubner (l. c.).

A study of the nutritive relations of a given food may be approached from three sides: First, from that of the exact chemical composition of the food, a knowledge absolutely essential to any scientific scheme of diet. Second, from that of the various excretions of the individual or animal upon the diet in question; and, third, from the more clinical standpoint of study of the effects exerted by a given diet upon the growth and nutritive processes of the organism under observation. After an examination of branny food in the light of the first two methods, we attempted its study by the third. To this end six young pigs of the same litter, and all in fair health, were weighed and placed under the same conditions in pairs in three separate bins. Those in the first bin daily received bread especially made from whole wheat flour, in amount corresponding to one-fourth pound of dry bread each. To those in the second bin was given a corresponding amount of bread made from wheat whose three external coats only had been removed. The pigs in the third bin received the best white bread in amount corresponding to the standard above mentioned. A sufficient (fixed) quantity of water was given twice daily. The following table shows the weight of each pair at the beginning of the observation, and at the end of respectively ten and thirty-two days thereafter:—

Bin.	Age.	Food.	Joint weight Mar. 6.	Joint weight Mar. 16	Joint gain 10 days	Joint weight Apr. 7.	Joint gain 32 days
	weeks.		lbs.	lbs.	lbs.	lbs.	lbs.
I.	6	Bread from whole wheat	24.5	29.0	4.5	33.25	8.75
II.	6	Brown bread from decorticated wheat	24.75	28.25	3.5	34.50	9.75
III.	6	White bread	25.25	27.25	2.0	33.0	7.75

Comparison of these weights exhibits curious and apparently contradictory results, viz., that during the first ten days the gain was greatest in the pigs fed upon whole wheat bread, whereas, at the end of thirty-two days of such feeding the gain was most pronounced in the pigs fed upon bread made from wheat whose three outer coats had been removed. The cause of this variation in results is not far to seek. At the commencement of the experiments the animals were small, and the food given was in each case more than sufficient to replace the waste in both the tissues, and circulatory fluids. Even the pair fed upon bread containing the innutritious and waste-inducing bran, digested and absorbed sufficient proteid matter to supply the needs of the tissues, and normal growth was also favored by the presence of a bulky intestinal contents of a mechanically stimulating nature, and also by the nutritive salts which were present in this bread in larger amounts than in the others. On the other hand, at the end of the thirty-two days, the animals had notably increased in size; the food given was then barely sufficient for the needs of the economy, and any conditions impeding its complete digestion and absorption produced a notable effect upon the rate of growth of these young animals.

It must be borne in mind that these experiments relate only to the value of the different breads when taken alone to the exclusion of other foods. The experiments of Rubner before cited leave no doubt that a white bread contains more assimilable nutriment than does one made from the whole wheat, but this does not render it a desirable food-stuff for exclusive use. On the contrary, a weaned, but still quite

young omnivorous mammal thrives better upon an exclusive diet of bran bread than on white, and, presumably, because the earthy and alkaline salts are present in greater abundance in the former, and, also, because the indigestible constituents tend to give to the intestinal contents that bulk and consistence which are essential to the hygiene of the digestive tract. But, as has been shown by Edward Smith and others, the branny scales are needlessly irritating, and unduly hasten the passage of food[1] but partially digested and absorbed. The end which popular hygiene attempts to effect by the retention of bran in breadstuffs can be better attained by other means. Thus the nutritive salts of food so frequently lost in ordinary methods of preparation are readily restored by the concentration of the liquor in which meats and vegetables are cooked, into a soup stock, as is practised in almost every French kitchen. Again, the various fresh green vegetables used as salads, yield in abundance these inorganic food-stuffs, the presence of which we have seen is indispensable to normal tissue activity. A further advantage of these and other succulent vegetables lies in the fact that their cellulose, while efficient in giving proper bulk and consistence to the stools, is, as compared with bran scales, soft and unirritating to the digestive tract.

From the facts, old and new, which have been presented, the following deductions appear to us justifiable:—

[1] An observation worthy of mention in this connection is that of Rubner, who finds that while the presence of much woody fibre and harder cellulose in the intestinal contents induces the passage of stools containing an excess of undigested proteid foods, the absorption of fats under the same conditions is not materially affected.

I. The carbohydrates of bran are digested by man to but a slight degree.

II. The nutritive salts of the wheat grain are contained chiefly in the bran, and, therefore, when bread is eaten to the exclusion of other foods, the kinds of bread which contain these elements are the more valuable. When, however, as is usually the case, bread is used as an adjunct to other foods which contain the inorganic nutritive elements, a white bread offers, weight for weight, more available food than does one containing bran.

III. That by far the major portion of the gluten of wheat exists in the central four-fifths of the grain, entirely independent of the cells of the fourth bran layer (the so-called "gluten cells"). Further, that the cells last named, even when thoroughly cooked, are little if at all affected by passage through the digestive tract of the healthy adult.

IV. That in an ordinary mixed diet, the retention of bran in flour is a false economy, as its presence so quickens peristaltic action as to prevent the complete digestion and absorption, not only of the proteids present in the branny food, but also of other foodstuffs ingested at the same time; and,

V. That inasmuch as in the bran of wheat as ordinarily roughly removed, there is adherent a noteworthy amount of the true gluten of the endosperm, any process which in the production of wheaten flour should remove simply the three cortical protective layers of the grain, would yield a flour at once cheaper and more nutritious than that ordinarily used.

Biological Laboratory of the Univ. of Penna.,
May 31, 1884.

ON A FORM OF NUMBNESS, CHIEFLY OF THE UPPER EXTREMITIES.

By

WHARTON SINKLER, M.D.

[Read June 4, 1884.]

For several years I have observed in my service at the "Infirmary for Nervous Diseases" in this city, and occasionally in my private practice, quite a large number of patients whose prominent symptom was numbness of the hands.

The symptoms in these cases are quite regular and constant in their general characters. The patients are usually women—at about the change of life,—although cases may occur in men, as will be seen from the instances given below.

The numbness generally begins in one or both hands and gradually extends up the arms. It may be felt in the feet and legs also. It is almost always most marked in the morning before the patient rises.

It is described as a "tingling," and "like pins and needles," or as if the limb "were asleep."

One patient, in whom the numbness was felt in both upper and lower extremities, said she felt like "a sleeping fool." Notwithstanding the numbness, there is but little loss of feeling to touch or pain, and usually the compass points are distinguished as readily in the affected part as in other portions of the body.

The numb member is weak, but there is no paralysis, and the weakness is transient. Often there is pain associated with the numbness. The patients sometimes think the hands are swollen at the time when the numbness is most marked.

I will give briefly the histories of some typical cases of the affection. It must be borne in mind that I do not consider all cases of numbness as coming under this head. There are many cases of numbness met with which do not depend upon organic lesions of the nervous centres and yet differ from those which I am now considering.

Case I.—Hannah R., æt. 30 years, single, coat maker, applied at Infirmary for Nervous Diseases February 6, 1872. Complains of numbness and pain in both hands and arms. It began three weeks ago in the hands, and the attacks now extend above the elbows. They are induced by sewing, and also come on at night. The numbness and pain begin in the ulnar distribution of the right hand and then extend to the rest of the hand and up the arm. In the left hand it is confined to the forefinger. Sensation is accurate in the affected regions. The ulnar distribution is affected readily by slight pressure over the course of the nerve. Some tenderness over the median nerve.

There is no spinal tenderness. The pulse is feeble, and there is a slight murmur heard at the base of the heart. There is some rheumatic stiffness of both wrists and decided difficulty in moving the right shoulder.

Under the use of galvanism and a very strongly stimulating liniment to the arms, the patient was entirely relieved of the numbness and pain.

Case II.—Letitia M., æt. 48 years, applied at the Infirmary for Nervous Diseases July 5, 1878. Has always been a

healthy woman, and has no history of rheumatism. About one year ago noticed numbness in the right hand; at first in the thumb and first and second fingers, and occasionally in the other fingers. In the beginning it was felt only in rising in the morning, but latterly it has remained all day in the first and second fingers. It is always worse in the morning. About two months ago, she noticed pain at the base of the thumb like a sprain. It comes on with any movements of the arm, and ceases when the limb is at rest. Any movements which require pressure with the thumb bring on pain. There is slight pain on pressure over the median nerve. Sensation to touch and the compass points in the hand and arm are normal.

Case III.—Catharine O'C., æt. 50, washerwoman, applied at the Infirmary for Nervous Diseases June 22, 1880. Catamenia have ceased for some time. Six months ago began to have numbness in the left hip, which extended down the leg. Has had an attack in the right hand. It is worse in the mornings.

Dynamometer, right 90, left 70.

Ordered ext. ergot. fld. gtt. xx t. d.

July 14. Returns saying that she is much better.

Case IV.—Mary M., æt. 60 years, applied at the Infirmary for Nervous Diseases September 15, 1880. Two years ago was cutting grass with scissors when she injured the forefinger of the left hand. This was followed by numbness of all of the fingers, and extended up the arm. The numbness and tingling are now in both arms. It is also felt in the legs. It is most marked at night when the patient is in bed, especially if she lies upon her back. The sensibility of the fingers is good, but there is slight loss to compass points. The numbness is most marked in the second and third fingers. The hands feel weak. Dynamometer, right 80, left 85. Ordered ext. ergot. fld. fl℥ss t. d.

October 13. Much better. Dynamometer, right 100, left 100.

Decrease ergot to gtt. xx t. d.

26*th*. Not so well. Increase dose of ergot to gtt. xl t. d., and apply mustard plasters over spine every night.

December 8. Dynamometer, right 115, left 100. Numbness very much less.

The patient continued to improve, and when last seen in May, 1882, stated that she was greatly relieved of the numbness, although it still occurred at times. If she allowed the arms to lie close by the sides when asleep, they became numb. If they were extended this did not take place.

Case V.—Mrs. B., æt. 50, nurse, applied at Infirmary for Nervous Diseases November 25, 1881. Menopause eighteen months ago. Is in good health with the exception of numbness of the hands, which began several years ago. There is no assignable cause for the numbness. The numbness is always in the ulnar distribution, and occasionally in the median distribution of hand and extends up the arm. It is decidedly most marked in the left hand and arm, and is occasionally felt in the left foot. The position of the arms had no influence in bringing on an attack of numbness, but prolonged exertion of the arm will induce it. There is always loss of power of the arm after the numbness has passed off. The dynamometer shows a difference of 20° in favor of the right hand. The patella reflexes are good; heart normal.

Case VI.—Mrs. J., æt. 51, applied at Infirmary for Nervous Diseases February 18. 1884. Two years ago used her right hand very much. Then began to have numbness in the fingers and hand. Following this, there was a burning pain. Her general health has been good, but she sleeps badly. The numbness begins in the fingers, and it is followed by a burning pain which also begins in the fingers, and extends up the arm as far as the elbow. It is most frequent in the early morning.

There is slight tenderness on pressure of the ulnar nerve at the elbow.

No loss of sensation to touch or to compass points. Dynamometer, right 80, left 95. Ordered ext. ergot fld. gtt. xx t. d.

February 25. Returned, saying that the numbness and pain are much relieved. Continued same treatment.

March 10. For the past few days symptoms have been worse. Is sleeping badly. Ordered to stop ergot and take sodii bromid. grs. xv t. d.

April 17. Reports that she was not so well while taking bromide. Returned to ergot of her own accord yesterday, and slept well last night. The numbness is also much less.

Case VII.—Mrs. M., æt. 50, widow, consulted me July 13, 1881. Has enjoyed good health and worked hard until recently. Catamenia regular until three years ago. Then she began to have numbness and pricking of the feet, with starting of the legs while in bed. The numbness then extended to the hands and arms. Numbness is now worse in left arm, but a month ago the right arm was most affected. The wrists are painful, and feel as if sprained. If the arms hang down the numbness is increased. The hands and legs become swollen. She has frequent "flushes of heat" through the whole body, and she then becomes flushed and warm, the sweat starting out freely. Her sleep is interrupted by the starting of the legs. She is a stout, florid woman; has a good appetite and no dyspepsia or constipation of the bowels. The urine is free from albumen. She is very nervous and often has headaches. The symptoms were markedly relieved by bromide of sodium and ergot.

Case VIII.—Charles E. S., æt. 34, carpenter, applied at the Infirmary for Nervous Diseases August 30, 1878. For a year he has had a sense of general fatigue, and for several months has had pain in the right shoulder. He has worked very hard both mentally and physically for some years. Since last fall has felt very sleepy all the time. A few days ago

noticed twitching of the right hand, and at night was wakened by pain and numbness in the palm of the hand and twitching of the fingers. Since that time the numbness and pain have continued, but are worse when he lies down, so that he is prevented from sleeping. He has had pain in the cervical region of the spine. The patient is obliged to use the right hand a good deal, as, for instance, in planing, and this brings on the attack of pain and numbness. On examination no twitching is seen, but the patient says there is a feeling as if the fingers were twitching. There is no loss of sensation in the right hand to touch or compass points. The right hand has become weaker. Dynamometer, right 130, left 130. Appetite poor; tongue furred; tendency to diarrhœa. The urine is free from albumen. Ordered potassii iodid. gr. x, vin. ergot. f ʒj t. d.

September 6, 1878. Is better. Can sleep now, but is awakened about 5 A. M. by pain and numbness in the right arm and shoulder.

11*th*. Improving, but the early morning pain and numbness continue. Increase wine of ergot to f ʒiij t. d.

18*th*. Now sleeps very well. No early morning pain and numbness.

This patient remained under treatment at intervals until September, 1881. He had occasional relapses; the attacks being almost invariably brought on by over use of the hand. At times the numbness extended to the right leg. The pain in the back of the neck was sometimes felt. The last note of the dynamometer was right 155, left 150. The treatment consisted in the free administration of ergot, and after the subsidence of the symptoms, phosphorus, strychnia, and iron were given for long periods. Blisters were applied on the cervical spine several times.

Case IX.—Mr. H. P. M., æt. 30, married. This patient had an attack of poliomyelitis anterior in 1877. I related his case at length in the *Amer. Journ. of the Med. Sci.* for Oct. 1878. He made a complete recovery from the paralysis, and

enjoyed excellent health until March, 1883. At this time he came to me complaining of numbness in the hands. The attacks came on in the early morning, and would waken him from sleep. At first he ascribed it to sleeping with his arms extended above his head, but it continues to occur no matter in what position the arms are. The patient is in good general health. No indigestion or rheumatism. The sensation in the hands is normal, the grip is weaker than before the numbness began. Dynamometer, right 156, left 120. He complains of an area of coldness in the right thigh above the knee. There is no anæsthesia or numbness in this region.

This case was treated at first with iodide of potassium and massage, and later with strychnia. The symptoms were gradually relieved, and the strength of the hands returned. On April 7, 1889, dynamometer marked right 160, left 130.

He still had occasional returns of numbness until Oct. 1883. At this time, however, the numbness was confined to the tips of the fingers, and did not disturb him until late in the morning.

Mr. M. consulted me again on March 17, 1884; he stated that he had remained free from numbness until lately. The attacks came on as before, *i. e.*, in the early morning, waking him at about 5 A. M. The numbness is worse in the right hand, and this hand is relatively weaker than the left. Dynamometer, right 142, left 136.

The hands feel as if they were swollen in the early morning.

Ordered ext. ergot. fld. gtt. xxx t. d.

April 4. Patient reports improvement. Numbness comes on later in the morning. Now ordered strychniæ sulph. gr. $\frac{1}{50}$ t. d. Ergot stopped.

26*th*. Better; sleeps until 6 A. M., but is then wakened by the numbness. Stop strychnia. ℞. Syr. d'ergotinine (Tanret's) f℥j t. d.

May 6. Patient thinks last prescription has had more decided influence in relieving the numbness than anything he has taken; the numbness comes on later every day. Dynamometer, right 158, left 142.

18*th*. Patient now has no numbness.

It will be seen that of the female patients whose cases I have given, their ages were between 48 and 60 years, with the exception of one who was 30 years. In this case the disorder was induced by the nature of her work, which was constant and hard sewing. The ages ranged as follows :—

1 aged 30 years.	1 aged 51 years.
1 " 48 "	1 " 60 "
3 " 50 "	

In two patients, Cases I. and VII., there were evidences of rheumatism, but in none of the others were there any symptoms of rheumatic trouble. In Cases I., IV., and VIII., the origin of the trouble seemed to be in overuse of the limb first affected. Indeed in Case VIII. the affection at first seemed like a low form of an ascending neuritis, but afterwards the symptoms were more general.

Most of the patients were in good general health, but some were anæmic or overworked.

The numbness in most instances was in both arms, occasionally it was found in all of the limbs, and in three cases in one arm alone. The ulnar and median distributions were most frequently affected.

Pain was associated with the numbness in several patients. It was not an acute pain like neuralgia, but as one patient expressed it, like the pain which comes when a limb is getting over being asleep. Tenderness over the ulnar or median nerve was observed several times. There was usually some loss of power in the parts involved. The dynamometer showing several degrees difference between the hands in the cases when only one limb was affected. The duration of the affection was from a few months to

several years. One of the patients had suffered from the disorder for two years before coming under observation, and at the end of a year and a half still had occasional attacks.

Dr. Weir Mitchell, in a lecture on "The Symptom Numbness,"[1] and later in a chapter in his work on *Diseases of the Nervous System*, has described several varieties of numbness. Most of his cases were in anæmic or hysterical persons, and the symptom yielded under a course of treatment which tended to improve the nutrition and *morale* of the patients. He refers to cases in which the numbness came on during sleep, and remarks that this is a form "which belongs to the night." He finds that the numbness in the cases he has seen is frequently hemiplegic in character, and alludes to the fact that "some persons who have gotten pretty well of a hemiplegia of organic cause are liable to waken out of sleep with numbness and lessened power of the side once palsied.

Dr. James J. Putnam, in a paper read before the American Neurological Association,[2] treats at length of a series of cases of "paræsthesia mainly of the hands." He bases his paper upon the notes of thirty-one cases, and the description he gives resembles those which I have related. He finds that most of his patients were women, and almost all were in middle life, but he does not remark upon the fact that they were about the period of the menopause.

Dr. Putnam suggests that the possible cause of the affection is, "alterations of the blood-supply of the

[1] Med. and Surg. Reporter, Dec. 2, 1876.

[2] Archives of Medicine, vol. iv. No. 2, Oct. 1880.

smaller branches or terminal filaments of the sensitive nerves supplying the affected districts."

The treatment of this writer consisted in the use of galvanism, phosphorus, strychnia, bromide of potassium, and several other drugs. He did not think that he had had sufficient opportunity to test the value of the different remedies, but seems to have found phosphorus of more value than any other one means used.[1]

Dr. J. A. Ormerod has described twelve cases[2] which very closely correspond to those which have come under my observation. All of his patients were women, and the attacks of numbness began to come on about the cessation of the menses. Three of his cases were rheumatic, and in some the trouble proceeded from the nature of their work. Bromide of potassium afforded marked relief in many of the cases. Dr. Ormerod compares this affection to the deadness of the fingers which some persons experience after exposure to cold, and therefore ascribes it to vascular spasm.

It has seemed to me that in these cases there is probably a condition of hyperæmia either of the nerve trunk or of a portion of the cord. In some cases I think the hyperæmia is confined to the nerve trunks or to some of the terminal filaments of the sensory nerves, but in others it seems not unlikely that the cervical enlargement of the cord becomes hyperæmic or congested, from the fact that the numbness is often

[1] In a note recently received from Dr. Putnam, he says that he has lately found lead in the urine of one of the patients referred to in his paper, and thinks that it should be looked for in all cases of numbness.

[2] Saint Bartholomew's Hospital Reports, 1883.

bilateral. The circumstance that the affection comes on at night seems to me to strengthen the view of the pathological condition being one of hyperæmia, for the supine position favors an increase of blood in the cord and the nerves of the extremities. I have seen patients in whom the numbness would come on if they lay down and fell asleep even for a short time in the day.

Women at the change of life are more prone to hyperæmias and congestions than at other periods of life, and they are the most frequent subjects of this form of numbness.

In several of my cases ergot gave marked relief, and Dr. Ormerod found bromide of potassium the most successful therapeutic means he used. Both of these remedies are believed to diminish the blood supply in the nervous centres. It is true that Dr. Putnam found phosphorus the most useful drug in his cases, but in one of those which he reports the remedy failed, and another was relieved by bromide of potassium.

From my experience in these cases I should say that the prognosis in middle-aged women was not good for permanent relief. The numbness can generally be greatly benefited or stopped for the time, but it is liable to return. In those cases when the trouble has been induced by overwork of the part one can almost surely promise permanent cure if the cause can be removed.

With regard to treatment, as indicated above, ergot has proved the most useful medicinal means I have employed. Massage and spinal galvanism are always useful adjuvants, and so are all means which

improve the general health. Bromide of potassium has helped some of my cases, and one patient was much benefited by sinapisms over the spine. It was found advantageous in most of the patients to give strychnia for a time after the disappearance of the numbness.

THE COMPOSITION AND METHODS OF ANALYSIS OF HUMAN MILK.

By

Prof. ALBERT R. LEEDS, Ph.D.

[Read, by invitation, May 7, 1884.]

In a previous paper, "On Infant Foods," which I read before the College of Physicians of Philadelphia, May 2, 1882, I alluded briefly to the investigation then in progress upon the Composition of Human Milk, and gave a tabular statement of the minimum, maximum, and average results of the analyses of 43 samples, the total number of analyses which I had made up to that date. Since then I have analyzed 37 more samples, and have verified the results by a critical examination of the various methods of analysis which are in use at the present time.

In the beginning of my previous paper, I asked the question, "What is human milk?" and stated that to answer this question satisfactorily, we should know at least three things: 1st. All the constituents; 2d. Their relative proportion; 3d. Their chemical and physiological properties. It is not my present object to discuss the first and third points, except in the light of the following isolated results which were only incidental to the main object of the present inquiry.

The albuminoids and fat of a large number of

samples, as obtained by precipitation with Ritthausen's solution, were extracted with ether, until the albuminate of copper ceased to give up any further traces of fat to the solvent. It then became after drying a very light-green amorphous powder.

In order to separate the albuminoids, this powder was digested with very dilute hydrochloric acid, which carries some of the organic matter into solution along with the copper. The residue, after washing and drying at 100°, formed brownish, somewhat brittle, amorphous masses.

The percentage of cupric oxide contained in this albuminate of copper was found in two analyses to be 20.93 per cent., and 20.63 per cent. The ultimate analyses of the albuminate, after deducting cupric oxide, yielded the following results:—

	I.	II.
	Per cent.	Per cent.
Carbon	49.07	49.17
Hydrogen	7.15	7.22
Nitrogen	14.67	.....
Sulphur	1.08	1.15

Two analyses of the total albuminoids, left behind after the foregoing treatment of the albuminate of copper with dilute hydrochloric acid, gave the following figures:—

	I.	II.
	Per cent.	Per cent.
Carbon	52.39	.....
Hydrogen	7.02	.....
Nitrogen	13.64	13.50
Sulphur	1.49	.....

The albuminoids, separated by hydrochloric acid from the copper albuminate, were digested with 50 per cent. alcohol, at the boiling-point. On cooling, the filtered solution deposited a white, flocculent,

voluminous precipitate, whilst the residue on the filter formed a somewhat brownish mass.

This precipitate would correspond to the "caseo-protalbin" of Danilewsky (*Jahresb. der Thierch.* 1880, 186), and the residue, which was much the larger in amount, to his "caseo-albumen."

An analysis of the caseo-protalbin gave :—

	Per cent.
Carbon	55.86
Hydrogen	6.07
Nitrogen	17.17

An analysis of the "caseine," obtained by Makris in quite a different manner from Woman's Milk, yielded for its composition, Carbon 52.35 per cent.; Hydrogen 7.27 per cent.; and Nitrogen 14.65 per cent.

The foregoing analyses render evident that the bodies examined are not homogeneous, and in every case the process of separation left behind mixtures of substances the true nature and composition of which are at present unknown. Moreover, the deportment and properties of the bodies examined are such as to lead one to the conclusion that the investigation was being conducted, not upon bodies in the condition and with the properties which they possessed originally in woman's milk, but upon substances whose composition and properties had been altered by the operation of the reagents employed.

It had been the intention of the author to endeavor to isolate the various constituents, at present very imperfectly known, of the fat of human milk. This desire had been increased by the fact that the ethereal extract of the copper albuminate, obtained from numerous samples, although not by any means from all, was

colored emerald-green by some copper salt. As to the chemical nature of this copper salt, going as it does in perfect solution in ether, I have no knowledge. Unfortunately, the entire mass of fats was lost by accident in the early stages of manipulation, and I shall have considerable difficulty in again procuring sufficient material to work upon. No sample of cow's milk which I have analyzed yielded to ether an emerald-colored solution. The unknown body is peculiar to woman's milk.

Methods of Analysis.

Passing by the methods of analyses which were employed when the nature of the difficulties to be overcome was imperfectly understood, and omitting from discussion in this paper the earlier results as obtained by Meggenhofen, Payen, Henri and Chevallier, L'Héritier, Quevenne, Simon, Clemm, Sherer, Donné, Heilen, Regnault, and Lehmann, the first method claiming our attention is that made use of by Vernois and Becquerel, in their essay "Du Lait chez la Femme," Paris, 1853.

Although regarded by the authors of the process as the smallest which they could employ, the amount of milk regarded by V. and B. as necessary for analysis is excessive, being 60 grammes.

Total Solids.—Of this, 30 grms. are taken for determination of total solids, which are found by evaporation to constant weight at 80° C. It is evident that the evaporation of so large an amount at so low a temperature not only requires very many hours, but presents great difficulties in the way of expelling the last traces of moisture.

Fat.—The total solids are exhausted on a filter with ether. The loss in weight is set down as fat. Or the ethereal extract after evaporation gives the weight of fat directly.

The estimation of fat by loss of weight involves numerous sources of error. And even the direct estimation according to this method is erroneous, inasmuch as ether very partially exhausts a dried residue of this nature. Consequently, the figures obtained by V. and B. for fat are much too low, the average in 89 samples being only 2.67 per cent.

The other 30 grms. are coagulated by boiling with some drops of acetic acid. The filtrate contains sugar, extractive matters, and soluble salts.

Milk Sugar.—Its determination by the saccharimeter, as performed by V. and B., gives less accurate results than those obtained by direct chemical methods.

Albuminoids.—The authors regard the nature of the extractive matters as so entirely unknown as to make their determination by analysis impossible, and set down under one head what they denominate "caseum and extractive matters." Its amount is found by subtracting the sum of the weights of fat, sugar, and ash from the total solids. If it were possible by their method to determine these four quantities correctly, the difference, which they style caseum united with extractive matters, would be the albuminoids. But, otherwise, the difference represents the algebraic sum of the errors committed in the various determinations, and this difference, in the present instance, the amount of fat and sugar as stated by V. and B. being much too low, is correspondingly too high, being 3.92 per cent.

Analysis by the same method as that usually employed for Cow's Milk.—This method, which is practised by some of the public analysts of New Jersey and New York, and which is a somewhat modified form of Wanklyn's, will be found stated in Cairns's Quantitative Analysis, p. 204.

The results obtained on sample of woman's milk, Laboratory No. 1133, were as follows:—

	Per cent.
Ash	0.21
Fat	2.62
Albuminoids	2.60
Milk sugar	8.19
Total solids by summation	13.62
Total solids by evaporation	13.63

The fat, as thus determined, is too low, although it was extracted by digesting the solids left after evaporation with boiling ether six times, and with cold ether as many times more.

The sugar is too high. After weighing it was redissolved in water, and the amount of albuminoids contained in it determined. This was 0.78 per cent., which, subtracted from the sugar, as determined in accordance with the method, left 7.41 per cent., which is the correct result.

The albuminoids are also too high, and the excess is still greater when the albuminoids contained in the sugar are added to those as determined in accordance with the method, the total being 3.38 per cent. This excess is due to fat.

Correcting the results, as found directly by the method, by the results obtained by separately analyzing the various educts, we have:—

	Per cent.	Per cent.
Fat, determined by method	2.62	
Fat, extracted from casein residue	2.18	
Actual fat		4.80
Albuminoids, determined by method	2.60	
Albuminoids, contained in sugar	0.78	
Sum of albuminoids	3.38	
Deduct fat found in caseine residue	2.18	
Actual albuminoids		1.20
Sugar, determined by method	8.19	
Deduct albuminoid found in sugar	0.78	
Actual sugar		7.41
Ash		0.21
Total solids, by summation		13.62
Total solids, by direct evaporation		13.63

Determination of the Albuminoids by Precipitation with Alcohol.[1]—20 c.c. of dilute acetic acid are added to weak acid reaction, then four volumes of strong alcohol, the mixture well stirred, allowed to settle during an hour, and filtered upon a weighed filter. The precipitate is washed six or eight times with cold sixty per cent. alcohol, then with ether, dried at 120–125° C. and weighed. The alcoholic filtrate is evaporated to small volume, the resultant precipitate transferred by means of sixty per cent. alcohol to a weighed filter, washed repeatedly with the same alcohol, and finally with ether. These filtrates are again evaporated to a small volume, the precipitate obtained dissolved in water, an aqueous solution of tannic acid added, the precipitate so obtained transferred to a weighed filter, washed first with water, then with alcohol and ether, dried at 120° and weighed. The three precipitates together contain all

[1] Handb. der Physiolog. Chem. Anal. Berlin, 1883, p. 491. Hoppe-Seyler.

the albuminoids. They must be ignited, and the amounts of ash deducted. This method gives too low results when the addition of tannic acid is omitted. The trial of this method, as performed on sample, Laboratory No. 1133, yielded the following results:—

	Per cent.
Albuminoids in first precipitate	0.66
" " second precipitate	0.55
" " third "	0.42
Total albuminoids so determined	1.63

The analysis of these albuminoids yielded:—

	Per cent.
Fat	0.00
Milk-sugar	0.43

Deducting this amount of milk-sugar, we have:—

	Per cent.
Total albuminoids as found	1.63
Deducting milk-sugar	0.43
Albuminoids actually present	1.20

Distilling off the alcohol and ether from the first and second precipitates and determining the milk-sugar in the collected filtrates from the albuminoids, I obtained:—

	Per cent.
Fat	4.80
Milk-sugar	6.98

These results make it evident, what, indeed, was feared during the whole course of the analysis by this method, that notwithstanding the great expenditure of time in washing these precipitates, the washing was incomplete, and some milk-sugar was left behind. This supposition is confirmed by the fact, that upon adding the milk-sugar contained in the albuminoid

precipitates to that contained in the filtrates, the sum is the correct percentage of sugar.

Determination of the Albumen and Peptone by Precipitation with Magnesium Sulphate.[1]—The assumption upon which this method is founded is that when crystallized magnesium sulphate is added to milk to the point of complete saturation, the caseine is completely precipitated, whilst the albumen and peptone are not. In the execution of the method, 40 c. c. of a saturated solution of magnesium sulphate are added to 10 grms. of milk, and afterwards crystals of the same salt are added in slight excess of the maximum quantity which can be made to enter into solution. After standing several hours with frequent stirring, the precipitate is transferred to a beaker and washed six or eight times with a saturated solution of magnesium sulphate. The collected filtrates are then diluted with water, a drop or two of acetic acid added, heated to boiling for a few minutes, filtered through a weighed filter, the precipitate washed first with water and afterward with alcohol, dried along with the filter at 120° to 125°, weighed and ignited. By subtracting the weight of ash from that of the precipitate, the amount of albumen is determined.

In the filtrate the peptone can be precipitated by means of tannic acid, or by phospho-tungstic and sulphuric acids.

I failed entirely in an attempt to perform an analysis by this method. Owing to the great density of a saturated solution of magnesium sulphate the caseine

[1] Handb. der Physiol. Chem. Anal. p. 492. Hoppe-Seyler.

did not precipitate, but formed a layer on the surface of the liquid, and so slow was the operation of filtration that I did not succeed in completely washing the caseine during the course of several days.

Haidlen's Method, as Modified by Christenn. Total Solids.—Instead of drying the milk at 110° with one-fifth of its weight of powdered gypsum, as proposed by Haidlen, Trommer proposed the use of pulverized marble, and Christenn employed powdered glass, the drying being conducted at 95° to 100° instead of 110°. Christenn found that the hygroscopic nature of the gypsum and its solubility in alcohol gave rise to errors, the latter property raising the percentage of milk-sugar and diminishing the percentage of albuminoids.[1]

Other Constituents.—To 10 grms. of milk add 10 c. c. ether and 20 c. c. alcohol, mix thoroughly, collect the precipitated albuminoids on a weighed filter, and wash with a mixture of ether and alcohol (1:2) until the filtrate runs through clear. The precipitate, dried at 95° to 100°, gives the weight of albuminoids and insoluble salts. By ignition, the weight of the latter is obtained, and the difference gives that of the albuminoids. The weight of evaporated filtrates gives the combined weight of the fat, milk-sugar, and soluble salts. The loss of weight after extraction with ether gives the fat. The soluble salts and sugar are ignited, the residue treated with hot water, the solution evaporated to dryness, and ignited. The weight of this ignited portion gives the soluble salts, and the milk-sugar is found by difference.

[1] The addition of gypsum, marble, glass, sand, etc., is unnecessary and a source of error.

NOTE. In the trial of this method I did not wash the precipitate of albuminoids and insoluble salts on the filter, but by decanting. The precipitate was shaken up six or eight times with the mixture of alcohol and ether, and the latter then pipetted off through a weighed filter. Finally, the albuminoids were thrown on the filter and washed exhaustively with the same mixture. The method of decantation is more rapid and thorough, but even with its aid and with the use in all of 250 c. c. of the mixed solvent, the washing of the albuminoids was incomplete, as shown by the following results of an analysis performed upon sample, Laboratory No. 1133.

Analysis according to the Haidlen-Christenn method :—

	Per cent.
Fat	2.90
Albuminoids	2.19
Sugar	8.23
Ash	0.21
Total solids	13.53

These various educts of the Haidlen-Christenn method were analyzed and separated into their individual constituents. The albuminoids were exhausted with ether, and the fat determined in the ethereal solution. The residue was then exhausted with water, and the sugar determined in the aqueous extract. In the final residue, containing according to Haidlen the sugar, the nitrogen was determined directly, and multiplied by 6.25 to obtain the percentage of albuminoids. The nature of the errors inherent in the method is strikingly shown when the corrected results obtained in this manner are compared with those stated in the preceding table :—

	Per cent.	Per cent.
Fat, extracted from the albuminoids	0.76	
Fat, extracted from sugar residue	2.90	
Fat, total as thus found		3.66
Albuminoids, determined by method	2.19	
Deducting fat in albuminoids	0.76	
Deducting sugar in albuminoids	0.16	
Actual albuminoids		1.17
Sugar in albuminoids	0.16	
Sugar in final residue	7.10	
Actual sugar	——	7.26
Ash		0.21
Total solids, as found by summation		12.30
Total solids, as found by evaporation		13.56
Loss		1.26

This loss of 1.26 per cent. represents fat, which I did not succeed in perfectly exhausting from the sugar residue after evaporation to constant weight, although the treatment with ether was performed very many times.

Meigs's Method.[1] *Total Solids and Ash.*—Pipette off 5 c.c. of milk into a platinum dish and weigh. Evaporate to dryness on a water-bath to constant weight. Incinerate, best over a blast-lamp, and weigh the ash.

Fat.—Weigh off 10 c.c. in another dish, and wash with the aid of 20 c.c. of water into a tall 100 c.c. stoppered cylindrical graduate. Add 20 c.c. ether, stopper, shake for five minutes, then add 20 c.c. alcohol, and shake five minutes more.

Allow the cylinder to stand until the ether has risen to the top, pipette off, add 5 c.c. ether, shake, allow to separate, pipette off, and repeat this operation

[1] Philadelphia Medical News, June, 1882.

five times. Evaporate off the ether in a weighed dish; the increase in weight is fat.

Casein and Sugar.—The remaining contents of the graduate, after the ethereal solution of fat has been removed, are washed into a platinum dish and evaporated to dryness on a water-bath. The residue is treated with boiling-water, and allowed to stand. The undissolved casein precipitates, the solution of sugar is poured off. This latter is again evaporated to dryness, and the same process of settling and decantation repeated. This must be done four or five times, until it is found that when boiling water is poured upon the dry sugar it dissolves completely, no flocculi of casein being seen in suspension. The casein residue is then, after being dried, treated once or twice with boiling water to extract sugar. This sugar is added to the main portion. Both casein and sugar are then evaporated over the water-bath to constant weight, incinerated over a blast-lamp, and the losses in weight give the amounts of casein and sugar respectively.

Experimental Trial of Method.—Total Solids. In the weighing out of milk it must be poured directly into the dish in which it is weighed. If a pipette be used, the milk leaves minute particles upon its walls, and the alteration in composition thus produced is the greater, the more extensive the wetted surfaces of the measuring vessel.

Evaporation to dryness on a water-bath to constant weight is tedious, usually requiring three hours, and is neither so accurate nor so expeditious as the method of coagulation with alcohol.

Thus with sample No. 1133:—

To 5.1195 grms. milk add 3 c. c. alcohol, evaporated to dryness on water-bath, an operation requiring one-half hour, and then to constant weight in air-bath at 105°, requiring with intervals for weighing one hour longer.

Loss of weight 0.699 grm. or 13.56 per cent.

Compare with this the results obtained by direct evaporation without coagulation.

Evaporated 5.059 grms. of same milk for three hours on water-bath.

Loss of weight, 0.6985 grm. or 13.81 per cent.

Dried the same for two hours longer in air-bath at 105°. The weight decreased to 13.59 per cent.

Dried the same for two hours longer at 103.° The weight decreased to 13.56 per cent. In other words, at the expiration of seven hours, I had obtained the same constant weight as I had found by the method of coagulation at the expiration of one and one-half hours.

The explanation of the difficulty of evaporating milk without addition of any kind is evident, the casein coagulated by heat forming a skin upon the surface of the milk which renders any further evaporation very difficult. Alcohol, on the other hand, divides the milk into fine coagula, which readily permit the escape of moisture.

Fat.—When water is present, ether will extract not only fat, but substances soluble in water. This was probably the case in the present instance, and experiment confirmed the conjecture. After distilling off the impure ether, drying the fat to constant weight at 105° and weighing, the fat thus obtained was redissolved in *absolute* ether. In every trial a

residue was left behind. This residue dissolved readily in water. It proved to be milk-sugar, and its percentage was determined and added to that found elsewhere.

Casein and Sugar.—The method has two objections. The albuminoids of milk, and more especially of woman's milk, are partly soluble in boiling water, and cannot be perfectly separated from milk-sugar by its use. In the second place, the finely-divided albuminoids left after evaporation to dryness and treatment with boiling water cannot be accurately separated by the crude method of settling and decantation. As a result, in case the albuminoids are washed in this manner so completely that they do not contain any milk-sugar, their amount will be much too low, whilst that of the sugar will be correspondingly too high. The percentage of albuminoids in the milk-sugar was determined by direct determination of contained nitrogen in the following test analyses.

An attempt was made to separate the albuminoids by decantation through a weighed filter, but the process was extremely tedious, the albuminoids so coagulated quickly gumming up the filter paper.

The results obtained were as follows, several analyses being made of the same sample, No. 1133.

	Per cent.
Fat, originally obtained	4.77
Fat, after redissolving in absolute ether	4.66
Containing by direct determination, milk-sugar	0.10
Fat as originally obtained	4.82
Fat, after redissolving in absolute ether	4.48
1st Trial.	
Albuminoids in residue	0.79
Albuminoids in milk-sugar	0.63
Total albuminoids	1.42

2d Trial.

Albuminoids on weighed filter	0.36
Albuminoids in milk-sugar	0.71
Total albuminoids	1.07

3d Trial.

Sugar as originally determined	8.30
Add sugar contained in fat	0.34
	8.64
Deduct albuminoids contained in milk-sugar	0.72
Actual milk sugar	7.92

Summary of Analyses.

	Per cent. (1)	Per cent. (2)
Ash (not with blast)	0.21	0.21
Fat	4.77	4.82
Albuminoids	0.79	0.36
Sugar	8.01	8.30
	13.78	13.69

The results obtained by Meigs's method will always differ from those by Hoppe-Seyler's, Haidlen's, and Christenn's methods, and from Ritthausen's method, by giving necessarily a lower percentage of ash, a higher percentage of fat, a lower amount of albuminoids, and a larger percentage of milk-sugar. These differences are inevitable, and depend upon errors inherent in the method.

Gerber-Ritthausen's Method.—After using for a considerable length of time the methods of milk analysis in common use, the author was led by a comparison of the results obtained thereby with those found by Ritthausen's method to abandon the other methods and adopt Ritthausen's. The latter, as modified by Gerber, has now been in constant use in his laboratory for more than two years, and hundreds

of analyses have been performed in accordance with it. The author regards it as the only method known at the present time, which is precise and rigidly accurate. Moreover, it is so rapid, and, when familiar, so easy of execution, that its employment soon becomes a source of pleasure and satisfaction.

Details of Method. Total Solids.—Weigh off 5 grms. of milk in a tarred covered platinum capsule. Coagulate with absolute alcohol (about 3 c.c. are used), and evaporate to dryness on water-bath. Transfer to drying-oven, and keep at 105° C. until constant weight is attained.

Ash.—Ignite the residue first over a small flame, and finally at a dull-red heat. Cover the dish, cool in the desiccator, and weigh.

Albuminoids.—Dissolve 63.5 grms. pure sulphate of copper in a liter of water. Prepare also a potash solution containing 50 grms. caustic potash in 1 liter.

Weigh out 10 grms. of milk in a covered beaker glass, and dilute with 100 c.c. water. Add 2.5 to 3 c.c. of the copper solution. Then run in sufficient potash to exactly neutralize the excess of sulphate, which will require about 1.25 to 1.5 c.c. of the potash. The coagulated albuminoids settle immediately, leaving the liquid clear. In testing the reaction, the stirring-rod, which has been washed and withdrawn from the solution as soon as the potash has been stirred in, is dipped into the clear supernatant liquid. A drop of this liquid should turn neutral test-paper neither blue nor red. Care should be exercised not to allow the stirring-rod to bring up particles of the coagulum, since these interfere with the reaction. The clear liquid is then decanted through a filter-

paper, previously dried at 110°, and weighed in a weighing-flask. The precipitate is then stirred up with 100 c.c. water, allowed to settle, the supernatant liquid again decanted through the filter, and, finally, the precipitate is washed upon it. The beaker is thoroughly cleansed with a rubber washer, and all these filtrates, amounting to about 240 c.c., are finally made up to exactly 250 c.c. for the determination of milk-sugar.

The filter paper containing the precipitate is then opened out upon a large watch-glass, and, after drying to a certain point, is divided up into small particles by a platinum spatula, and this comminution is repeated from time to time until finally the whole mass becomes a fine powder.

Fat.—The filter paper containing the precipitate is gathered up and placed loosely in a proper funnel. The beaker-glass used for the precipitation is washed out with ether to dissolve any traces of fat adhering to it, and these ethereal washings are poured through the funnel and allowed to run into a small weighed flask, with which the funnel is connected by a ground-glass joint. The funnel is then connected with a return cooler, the flask carefully heated by a water-bath, and the filter paper is made to swim in the ether condensed in the funnel for about an hour, when the extraction of fat will be complete. The ether is distilled off, the flask dried at a temperature of 105°, cooled in a desiccator, and weighed. Its increment in weight gives the amount of fat.

Albuminoids.—The residue in the filter is dried at 110°, and weighed in the weighing flask until constant weight is attained. It is then ignited in a

platinum crucible, and the weight of ash deducted. The loss of weight is the amount of albuminoids.

Milk Sugar.—This is determined in the filtrate by Fehling's solution. The figures thus obtained are identical with those found by evaporation of the filtrate to dryness, igniting, and subtracting ash.

In case the above method is carefully followed, the sum of the several constituents as separately determined will not differ by an appreciable quantity from the amount of solid matter as determined directly by evaporation. Thus, it will be seen from the accompanying table, giving the results of 62 separate analyses of human milk (excluding Laboratory No. 1063 as being manifestly affected by some accidental error), the maximum difference is 0.21 per cent.

The average error, as determined by ordinary arithmetical methods, is 0.001 per cent. The probable error of any individual analysis, as determined by the method of least squares, is a difference of 0.0098 per cent. in the sum of the several constituents as found by addition, and the sum as determined by direct evaporation.

This close agreement does not itself prove the accuracy of the methods employed. But, in connection with the fact that an analysis of the fat showed no trace of albuminoids or sugar, that an analysis of the albuminoids revealed no sugar or fat, and that an analysis of the sugar showed no albuminoids or fat, it does afford such proof.

The only serious objection to the method is that, in the precipitation of the albuminoids by Ritthausen's solution, hydrated basic sulphate of copper is precipitated at the same time, and that this hydrate does

not lose its water at the temperature at which drying of the albuminates is effected. Hence, the weight obtained would be in excess of the true amount. This objection is not borne out by the results of analyses of the precipitated cupric albuminate, since I have failed to detect in it the presence of more than traces of hydrated basic sulphate.

History of Samples Analyzed.

Samples 42 to 55 inclusive were obtained by Dr. K. Parker from inmates of the Infants' Asylum of New York; all the others were obtained by Dr. A. M. Thomas, Chief of Medical Staff of the Emigrants' Asylum and Hospital. Both of these physicians have given their personal attention to the collection of the samples, and in every instance tabulated the physical history of the mother under the following heads:—

I. Mother's name and nationality.
II. Married or single.
III. Age.
IV. Color of hair, etc.; blonde or brunette.
V. Period of lactation.
VI. Right or left breast, or both.
VII. Quantity obtained.
VIII. Time after last nursing.
IX. Time of day.
X. Number of parturitions.
XI. Presence or absence of menstruation.
XII. Present or former illnesses. Child-bed convalescence.
XIII. Physical antecedents of mother and parents.

XIV. Mother's diet.
XV. Health of infant.
XVI. Height of infant at birth, and at collection of sample.
XVII. Age of infant.

It is not necessary to give in detail all these statistics. The mother's diet in every instance was simple, but abundant and nutritious. Only normal milks were analyzed, such as came from healthy women; these presented, when submitted to the microscope, a normal appearance.

The physical history of mothers and infants is given, as far as our present purposes require, in the accompanying tables.

TABLE I.—HISTORY OF SAMPLES ANALYZED.

I.	II.	III.	IV.	V.	VI.		VII.	VIII.	IX.	X.	XI.
					Breast.				Infant's weight.		
No.	Mother's age.	Nationality	Color of hair.	Period of lactation.	Right	Left.	Interval since nursing.	Parturitions.	At birth.	At present.	Infant's age.
13	28	German	Brown	1 day	....	L.	2 hours	1	6 lbs. 5 oz.	.....	3 days.
14	28	German	Dk. b'wn	1 "	....	L.	2 "	2	6 " 12 "	.....	3 "
7	19	Irish	Dk. b'wn	2 days	½ R.	½ L.	5 "	1	5 " 11 "	.....	Died.
18	..	Nos. 7–35	.....	6 "	½ R.	½ L					
28	..	same	.....	19 "	....	L.					
35	..	mother	.....	29 "	½ R.	½ L.					
47	26	American	Brown	2 "	½ R.	½ L.	2 "	1	9 " 6½ "	.....	3 days.
6	33	Pole	Dk. b'wn	2 "	R.	....	5 "	9	7 " 0 "	6 lbs. 12 oz	4 "
38	20	German	Brown	2 "	½ R.	½ L.	3 "	1	8 " 11 "		
15	22	German	Light	3 "	....	L.	2 "	1	9 " 15 "	.....	5 "
16	..	No. 15 to	A	5 "	....	L.					
26	..	No. 30	typical	13 "	....	L.	2 "				
29	..	same	Blonde	17 "	....	L.					
30	..	mother	.....	27 "	½ R.	½ L.					
40	24	Negress	Black	3 "	½ R.	½ L.	20 min.	1	6 " 0 "	.....	4 "
64	24	Hungarian	Black	3 "	R.	....	30 "	2	8 " 6 "	.....	4 "
8	29	German	Lt. b'wn	4 "	....	L.	4½ hours	1	8 " 4 "	7 " 12 "	5 "
45	22	American	Brown	5 "	½ R	½ L.	2 "	1	5 " 13½ "	.....	5 "
67	28	Scotch	Fair	5 "	½ R.	½ L	30 min.	3	.....	.....	5 "
41	23	Irish	Black	6 "	½ R.	½ L.	30 "	1	.....	.....	8 "
21	18	English	Black	8 "	R.	....	1 hour	1	.....	.....	9 "
32	28	German	Dk. b'wn	10 "	½ R.	½ L.	0 min.	5	.....	9 " 0 "	10 "
34	23	German	Brown	10 "	½ R	½ L.	1 hour	2	.....	7 " 8 "	10 "
33	23	Irish	Dk. b'wn	11 "	½ R.	½ L	0 "	1	.....	8 " 4 "	Dead.
65	..	Dane	Light	12 "	½ R.	½ L	1 "	1	.....	7 " 12 "	13 days.
4	23	Irish	Dk. b'wn	13 "	....	L.	3 hours	2	7 " 5 "	7 " 10 "	14 "
39	23	Irish	Brown	13 "	½ R.	½ L.	0 "	2	.....	.....	Dead.
48	22	American	Red	17 "	½ R.	½ L.	2 "	1	.....	7 " 1½ "	17 days.
31	20	German	Dk. b'wn	19 "	½ R.	½ L.	½ hour	..	4 " 14 "	5 " 2 "	21 "
24	29	Italian	Black	20 "	½ R.	½ L.	¼ "	2	.....	.....	21 "
9	29	Irish	Brown	22 "	....	L	5 hours	5	6 " 10 "	8 " 8 "	24 "
51	16	American	Dk b'wn	23 "	....	L.	2 "	1	9 " 2 "	.....	23 "
68	22	German	Lt. b'wn	23 "	½ R.	½ L.	1 hour	1	.....	6 " 3 "	24 "
3	19	German	Brown	25 "	....	L.	4½ hours	1	7 " 0 "	7 " 8 "	27 "
5	21	Irish	Brown	26 "	½ R.	½ L.	6 "	1	6 " 12 "	7 " 8 "	27 "
2	21	Irish	Dk. b'wn	27 "	R	....	2 "	2	6 " 2 "	8 " 3 "	29 "
66	25	German	Dk. b'wn	30 "	¼ R.	½ L.	½ hour	2	.....	.....	30 "
12	23	Irish	Brown	41 "	....	L.	5 hours	1	8 " 12 "	8 " 13 "	44 "
1	19	German	Brown	45 "	¼ R.	½ L	5 "	1	7 " 8 "	8 " 2 "	45 "
17	..	same as 1	.....	49 "	½ R.	½ L.	.....	..	.....	8 " 5 "	
11	18	German	Lt. b'wn	46 "	....	L	3 "	1	6 " 0 "	8 " 0 "	48 "
20	30	Slavonic	Brown	50 "	½ R.	¼ L.	½ hour	1	5 " 8 "	9 " 8 "	52 "
23	26	Bohemian	Brown	53 "	R.	....	1 "	6	.....	.....	55 "
10	25	Scotch	Brown	82 "	....	L.	5 hours	2	6 " 10 "	11 " 3 "	83 "
53	19	Irish	Red	88 "	¼ R.	½ L.	2 "	1	7 " 8 "	13 " 5 "	88 "
27	28	German	Lt. b'wn	89 "	¼ R.	¾ L.	¾ hour	1	.....	.....	90 "
52	25	Swedish	Light	90 "	½ R.	½ L.	2 hours	1	7 " 5 "	11 " 3 "	92 "
55	27	German	Brown	93 "	½ R.	½ L.	3 "	1	5 " 8 "	.....	Still-born.
25	20	Irish	Brown	115 "	....	L.	2 "	1	7 " 8 "	.....	116 days.
19	23	Irish	Dk. b'wn	126 "	½ R.	½ L.	1 hour	1	7 " 8 "	13 " 11 "	128 "
54	19	German	Dk. b'wn	132 "	½ R.	½ L.	2 hours	1	8 " 13 "	14 " 7 "	132 "
43	30	American	Brown	150 "	½ R.	½ L.	2 "	3	7 " 14 "	13 " 4½ "	150 "
42	20	Irish	Brown	167 "	½ R.	½ L.	2 "	1	6 " 13½ "	13 " 12½ "	167 "
22	33	Swedish	Brown	180 "	½ R.	½ L.	¼ hour	1	.....	.....	Dead.
44	25	American	Light	180 "	½ R.	½ L.	2 hours	3	7 " 12 "	22 " 7 "	182 days.
46	24	Mulatto	Black	186 "	½ R.	½ L.	2 "	2	5 " 13 "	15 " 4½ "	186 "
50	21	American	Lt. b'wn	217 "	½ R.	½ L.	2 "	1	.....	15 " 3 "	218 "
49	19	Irish	Lt. b'wn	270 "	½ R.	½ L.	2 "	1	6 " 13 "	16 " 9½ "	272 "
60	25	Scotch	Lt. b'wn	21 "	½ R	½ L.	5 min.	1	.....	5 " 8 "	21 "
61	28	German	Brown	12 "	½ R.	½ L.	5 "	2	.....	7 " 10 "	13 "
62	30	Irish	Black	27 "	½ R.	½ L.	5 "	1	7 " 8 "	.....	29 "
63	22	Irish	Lt. b'wn	19 "	½ R.	½ L.	5 "	1	.....	8 " 3 "	21 "
56	..	French	Dk. b'wn	210 "	R.	....	1 hour	5	.....	18 " 0 "	210 "
57	..	Irish	Brown	90 "	R.	....	2 hours	1	.....	13 " 10 "	90 "
58	..	Irish	Dk. b'wn	153 "	½ R.	½ L.	2 "	1	.....	14 " 2 "	153 "
59	..	Irish	Lt. b'wn	92 "	R.	....	2 "	3	.....	13 " 4 "	92 "
36	..	.....	.....				Descriptions lost.				
37	..										

TABLE II.—ANALYSES OF 80 SAMPLES OF HUMAN MILK.

Number on blank.	Laboratory number	Color.	Spec. grav.	Albuminoids.	Milk-sugar.	Fat.	Solids not fat.	Ash.	Total solids by addition of constituents.	Total solids directly by evaporation.	Difference.
1	1021	Yellow	1.0321	1.44	7.20	5.58	8.81	0.17	14 39	14.46	—0.07
2	1022	.....	1.0351	1 68	7.53	3 55	9.42	0.21	12 97	12.84	+0.07
3	1023	White	1.0353	1.96	7.31	4.62	9.45	0.18	14.07	13.96	+0.11
4	1024	.....	1.0346	1.73	7.25	2.95	9.19	0.18	12.11	11.96	+0.15
5	1025	White	1.030	1.49	7.23	2.12	8.90	0.18	11.02	11.11	—0.09
6	1026	Yw.-white	1.030	1.45	7.24	3.20	8.93	0.24	12.13	12.10	+0.03
7	1027	Yellow	1.034	3.12	6 47	5.49	9.91	0.32	15.40	15.35	+0.05
8	1028	Yellow	1.030	2.15	6.51	2.31	8 94	0.28	11.25	11.40	—0.15
9	1029	....	1.032	2.05	7.08	3.00	9.26	0.13	12.26	12.31	—0.05
10	1030	.....	1.030	1.43	7.19	2.11	8 81	0.19	10.92	10.91	+0.01
11	1031	.....	1.031	1.98	6.99	3.06	9.17	0.20	12.23	12.21	+0.02
12	1032	.....	1.031	1.76	6.97	2.44	8.93	0.20	11.37	11.40	—0.03
13	1033	.....	1.030	2.40	6.45	6.01	9.07	0.22	15.08	15.07	+0.01
14	1034	.....	1.032	2.52	6.44	4 95	9.23	0.27	14 18	14.16	+0.02
15	1035	.....	1.032	2.18	6.75	2.84	9.06	0 13	11.90	11.88	+0 02
16	1036	Yellow	1.030	0.85	5.50	6.16	6.57	0.22	12.73	12.73	0.00
17	1037	Yellow	1.034	1.49	7.37	5.02	9 03	0 17	14.05	14.18	—0.13
18	1038	Dull-white	1.033	3.95	7.92	4 37	12.09	0 22	16.46	16.55	—0.09
19	1039	.....	....	....	....	....	....	0.15	.....	12.34	....
20	1040	.....	....	....	....	....	...	0.30	.....	14 08	....
21	1041	.....	....	....	....	....	....	0.22	.....	13.01	....
22	1042	.....	....	....	....	....	....	0.21	.....	12.74	....
23	1043	.....	1.030	2.10	6.61	4.02	8.91	0.20	12.93	12.88	+0.05
24	1044	.....	1 030	1.94	7.45	3.61	9.56	0.16	13 17	13.02	+0.15
25	1045	.... .	1.032	2.16	7.00	5.84	9.38	0.22	15.22	15.18	+0.04
26	1046	.....	1.030	2.08	6.98	3.28	9.26	0.20	12.54	12.39	+0.15
27	1047	.....	1.031	1.98	7.00	2.44	9.19	0.21	11.63	11.84	—0 21
28	1048	White	1 031	2.23	7.39	2.95	9.83	0.21	12.78	12 95	—0.17
29	1049	White	1.030	1 81	6.88	2.80	8.89	0.20	11 69	11.70	—0.01
30	1050	Yw -white	1.031	2 11	7.41	5.04	9.72	0.20	14.76	14.69	+0.07
31	1051	Chalky-white	1.033	2.27	6.75	5.96	9.17	0.15	15.13	15.21	—0.08
32	1052	Yw.-white	1.030	1.53	5.84	5.62	7.21	0.14	12.83	12.99	—0.16
33	1053	Yellow	1.030	2.24	6.25	2.76	8.84	0.35	11.60	11.45	+0.15
34	1054	Chalky white	1.034	2.19	7.46	6.89	9.90	0.25	16.79	16 66	+0.13
35	1056	White	1.032	2.43	7.34	3.13	9.98	0.21	13.11	13.20	—0 09
36	1057	Yellow	1.031	2.43	7.23	3.79	9.88	0.22	13.67	13.63	+0.04
37	1058	Chalky-white	1.032	1.60	7.55	6.21	9.37	0.22	15 58	15.45	+0.13
38	1064	White	1.021	1.82	6.96	3.97	8.97	0.19	12.94	12.87	+0 07
39	1065	Yw.-white	1.030	2.33	5.78	4.21	8.32	0.21	12.53	12.57	—0.04
40	1066	Yellow	1.032	1.75	6.94	3.68	8.97	0.28	12.65	12.52	+0.13
41	1067	White	1.031	2.45	6.08	3.82	8.72	0.19	12.54	12.41	+0 13
42	1055	White	1.031	1.97	7.38	4.16	9.60	0.25	13.76	13.60	+0.16
43	1059	Chalky-white	1.031	1.50	7.32	5.77	9.00	0.18	12.77	12.64	+0.13
44	1060	White	1.030	1.49	7.31	4.34	9 01	0.21	13.35	13 17	+0.18
45	1061	Yw.-white	1.031	2.33	7.48	2.47	9.97	0.16	12.44	12.36	+0.08
46	1062	White	1.031	1.35	7.24	4.09	8.89	0.31	12.98	13.15	—0.17
47	1063	Yellow	1.032	4.86	5.40	3 36	9.46	0.20	13.82	13 35	+0 47
48	1068	Yw.-white	1.032	1.93	6.95	5.59	9.06	0.18	14.65	14.58	+0.07
49	1069	White	1.031	2.00	6.95	4.64	9.16	0.21	13.80	13.74	+0.06
50	1070	White	1.031	2.06	6.39	4.75	8.62	0.22	13.44	13.48	—0.04
51	1071	Yellow	1.030	2.42	6.95	5.60	9.56	0.19	15.16	15.25	—0.09
52	1072	White	1.030	2.15	6.76	6.78	9.07	0.16	15.85	15.89	—0.04
53	1073	White	1.029	1.82	6.83	4.28	9.02	0.37	13.30	13.30	0.00
54	1074	Yw.-white	1.030	1.50	7.34	3.10	8.92	0.18	12.02	12 12	—0.10
55	1075	White	1.026	2.43	6.57	4.94	9.27	0.27	14.21	14 20	+0.01
56–59	1133	.....	1.0297	1.16	7.41	4.74	8.78	0.21	13.57	13.63	—0.06
60–63	1134	.....	1.0296	1.95	7 02	3 85	9.19	0.22	13.04	13.12	—0.08
64	1135	.....	1.0312	2.00	6.69	3 96	9.01	0.32	12.97	13.05	—0.08
65	1137	.....	1.0319	2.25	7.12	5 85	9.52	0.15	15 37	15.35	+0.02
66	1138	.....	1.0307	1.11	7.07	2.73	8.40	0.22	11.13	11.13	0.00
67	1139	.....	1.0322	1.96	7.28	4.74	9.54	0 30	14.28	14.28	0.00
68	1140	.....	1.0317	2.17	7.44	4.36	9.90	0.29	14 26	14.26	0.00
Robust	6 cases	.....	1.031	1.44	6.94	3.71	8.63	0.25	12.34	12.37	—0.03
Anæmic	6 cases	.....	1.031	2.12	6.74	3.96	9.02	0.22	13.10	13.08	+0.02
Maximum		.....	1.0353	4 86	7.92	6 89	12.09	0.37	16.79	16 66	0.21
Minimum		.....	1.0260	0.85	5.40	2.11	6.57	0.13	10.92	10.91	0 00
Average		.....	1.0313	1.995	6.936	4.131	9.137	0.201	13.268	13.267	0.001

COMPARISON OF FINAL RESULTS WITH PREVIOUS ANALYSES.

Analyses of Eighty Samples of Woman's Milk.

		Reaction uniformly alkaline.		
		Average.	Minimum.	Maximum.
I.	Specific gravity . .	1.0313	1.0260	1.0353
II.	Albuminoids . .	1.995	0.85	4.86
III.	Sugar	6.936	5.40	7.92
IV.	Fat	4.131	2.11	6.89
V.	Solids not fat . .	9.137	6.57	12.09
VI.	Ash	0.201	0.13	0.37
VII.	Total solids (by addition of constituents) . .	13.268	10.92	16.79
VIII.	Total solids (directly by evaporation) . .	13.267	10.91	16.66
IX.	Difference between VII. and VIII. . .	0.001	0.00	0.21
X.	Water . . .	86.732	89.08	83.21

The most interesting comparison which can be made is that with the results given by König (*Chemie der Mensch. Nahrungs und Genussmittel*), which are deduced from the analyses of samples. These analyses, it should be remembered, were performed according to the most diverse methods, errors in opposite directions operating to mutually compensate one another.

Analyses of samples of woman's milk (König) :—

	Average.	Maximum.	Minimum.
Albuminoids	1.94	0.57	4.25
Sugar	6.04	4.11	7.80
Fat	3.90	1.71	7.60
Ash	0.49	0.14	1.78(?)
Water	87.09	83.69	90.90

As might be anticipated, the extremes are wider apart than in my own analyses, but the general mean of all, with exception of the ash, is tolerably concordant.

Omitting particular reference to the results of Fernois and Becquerel and earlier investigations, I will quote further only the results of Gerber (mean of six analyses), Christenn and Marchand (*Beilstein's Handb. der Organ. Chem.*, 2081).

	Gerber.	Christenn.	Marchand.
Albuminoids	1.8	1.9	1.7
Sugar	5.4	6.0	7.1
Fat	5.3	4.3	3.7
Solids not fat . . .	7.2	8.2	9.0
Ash	0.4	0.3	0.2
Total solids by evaporation .	10.9	12.8	12.7
Water	89.1	87.2	87.3

Biedert (*loc. cit.*) found the albuminoids to vary, in the samples which he analyzed, between 1.5–2.4 per cent.; fat, between 3.8 to 4.4 per cent. His mean for albuminoids is 1.95; my own is 1.995; König's is 1.94 per cent.

Two per cent., therefore, may be regarded, without sensible error, as *the average amount of albuminoids in woman's milk.*

The more extended series of eighty analyses confirm, however, the statements made in my earlier paper (that on Infant Foods), the albuminoids being the most variable constituent of woman's milk, the fat the next most variable, and the sugar the least. Nor have I any reason to alter the interpretation therein given of the physiological signification of the greater and less variability of the individual constituents.

Relations between the Physical History of the Milk and its Composition.

Relations between the physical history of the milk and its composition.

The only relations which I shall attempt to discuss here are those appertaining to the

1st. Color, taste, consistency, and specific gravity.

2d. Age of the mother.

3d. Period of lactation, and interval since nursing.

4th. Nationality.

5th. Physical constitution of the mother.

I. *Color, Taste, etc.*—Whether bluish-white, chalky-white, whitish, yellowish-white, or yellow, the color is no indication of the composition. For example, the milk of a German brunette, taken one hour after previous nursing and during the tenth day of lactation, was chalky-white in color, whilst it contained 6.89 per cent. of fat. This was the largest percentage of fat in any sample. On the other hand, though many of the yellow samples were rich in fat, other yellow samples were very poor. Thus, No. 8 was yellow (the milk being drawn during the fourth day of lactation, and four and one-half hours after nursing), while it contained only 2.31 per cent. of fat.

Taste.—Although the amount of sugar in woman's milk is large, being nearly 7 per cent. or 2 per cent. more than in cow's milk, it is rarely sweet to the taste. Usually, it has a more or less saline, somewhat disagreeable animal flavor.

Consistency.—Although the amount of solids in woman's milk is decidedly greater than in cow's milk, its consistency is much thinner and more watery.

Specific Gravity.—The average is somewhat greater than in cow's milk, though the entire range of variation is not very different. Thus, in the 80 samples examined, the average specific gravity is 1.0313, the minimum 1.026, the maximum 1.0353. Conrad obtained in 130 observations for the two last figures 1.025 and 1.039. In 147 samples of normal cow's milk L. Janke found 1.0245 for the minimum, 1.034 for the maximum, and 1.0297 for the mean.

II. *Age of Mother.*—The milk of women under the age of 20 is richer in each and every constituent than that of older women. The general average of *albuminoids* for the first lustrum is 2.18 per cent., while it is only 1.92 per cent. for the second, and 2.10 for the third. The difference is still more striking in regard to sugar. In the first lustrum the sugar is 7.17 per cent., falling to 6.91 in the second lustrum, and in the third only 6.77 per cent. This falling off is notable, not only in the percentages, but in the number of samples which exceed the average. Thus, in the first lustrum, 83 per cent. of the whole number of samples exceed the general average in sugar, while in the second lustrum only 60 per cent. exceed. A similar diminution is observable in the fat and total solids.

TABLE III.—MILK OF WOMEN FROM 15 TO 20 YEARS OF AGE.

(First lustrum.)

A = No. of cases above or below the general average.
B = Averages for A.
C = Averages for women from 15 to 20 years of age.
D = General averages for all years.

No. of sample.	Albuminoids.		Milk sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
	Above av.	Below av.	Above av.	Below av.	Ab. av.	Bel. av.	Above av.	Below av.	Above av.	Below av.	Above av.	Below av.
7	3.12	.....	.....	6.47	5.49	.....	9.91	.....	0.32	.....	15.35	
18	3.95	.....	7.92	.....	4.37	.....	12.09	.....	0.22	.....	16.55	
28	2.23	.....	7.39	.....	.....	2.95	9.83	.....	0.21	.....	.....	12.95
35	2.43	.....	7.34	.....	.....	3.13	9.98	.....	0.21	.....	.....	13.20
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.01
51	2.42	.....	6.95	.....	5.60	.....	9.56	.....	.....	0.19	15.25	
3	.....	1.96	7.31	.....	4.62	.....	9.45	.....	.....	0.18	13.96	
1	.....	1.44	7.20	.....	5.58	.....	.....	8.81	.....	0.17	14.46	
17	.....	1.49	7.37	.....	5.02	.....	.....	9.03	.....	0.17	14.18	
11	.....	1.98	6.99	.....	.....	3.06	9.17	.....	.....	0.20	.....	12.21
53	.....	1.82	.....	6.83	4.28	.....	.....	9.02	0.37	.....	13.30	
54	.....	1.50	7.34	.....	.....	3.10	.....	8.92	.....	0.18	.....	12.12
49	2.00	.....	6.95	.....	4.64	.....	9.16	.....	0.21	.....	13.74	
A	VI.	VI.	X.	II.	VIII	IV.	VIII.	IV.	VI.	VI.	VIII.	V.
B	2.70	1.69	7.27	6.65	4.95	3.06	9.89	8.94	0.26	0.18	14.60	12.29
C	2.18		7.17		4.32		9.58		0.22		13.87	
D	1.995		6.936		4.131		9.137		0.201		13.267	

TABLE IV.—MILK OF WOMEN FROM 20 TO 25 YEARS OF AGE.

(Second lustrum.)

A = No. of cases above or below the general average.
B = Averages for A.
C = Averages for women from 20 to 25 years of age.

No. of sample.	Albuminoids.		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
	Above av.	Below av.	Above av.	Below av.	Ab. av.	Bel. av.	Above av.	Below av.	Above av.	Below av.	Above av.	Below av.
38	.....	1.82	6.96	.....	.....	3.97	.....	8.97	.....	0.19	.....	12.87
15	2.18	.....	.....	6.75	.....	2.84	.....	9.06	.....	0.13	.....	11.88
16	.....	0.85	.....	5.50	6.10	.....	.....	6.57	0.22	.....	.....	12.73
29	.....	1.81	.....	6.88	.....	2.80	.....	8.89	.....	0.20	.....	11.70
30	2.11	.....	7.41	.....	5.04	.....	9.72	.....	.....	0.20	14.69	
40	.....	1.75	.....	6.94	.....	3.68	.....	8.97	0.28	.....	.....	12.52
64	2.00	.....	.....	6.69	.....	3.96	.....	9.01	0.32	.....	13.05	
45	2.33	.....	7.48	.....	.....	2.47	9.97	.....	.....	0.16	.....	12.36
43	.....	1.50	7.32	.....	.....	3.77	.....	9.00	.....	0.18	.....	12.64
34	2.19	.....	7.46	.....	6.89	.....	9.90	.....	0.25	.....	16.66	
33	2.24	.....	.....	6.25	.....	2.76	.....	8.84	0.35	.....	.....	11.45
4	.....	1.73	7.25	.....	.....	2.95	9.19	.....	.....	0.18	.....	11.96
39	2.33	.....	.....	5.78	4.21	.....	.....	8.32	0.21	.....	.....	12.57
48	.....	1.93	6.95	.....	5.59	.....	.....	9.06	.....	0.18	14.58	
31	2.27	.....	.....	6.75	5.96	.....	9.17	.....	.....	0.15	15.21	
68	2.17	.....	7.44	.....	4.36	.....	9.90	.....	0.29	.....	14.26	
5	.....	1.49	7.23	.....	.....	2.12	.....	8.90	.....	0.18	.....	11.11
2	.....	1.68	7.53	.....	.....	3.55	9.42	.....	0.21	.....	.....	12.84
12	.....	1.76	6.97	.....	.....	2.44	.....	8.93	.....	0.20	.....	11.40
25	2.16	.....	7.00	.....	5.84	.....	9.38	.....	0.22	.....	15.18	
42	.....	1.97	7.38	.....	4.16	.....	9.60	.....	0.25	.....	13.60	
33	2.24	.....	.....	6.25	.....	2.76	.....	8.84	0.35	.....	.....	11.45
46	.....	1.35	7.24	.....	.....	4.09	.....	8.89	0.30	.....	.....	13.15
50	2.06	.....	.....	6.39	4.75	.....	.....	8.67	0.22	.....	13.48	
26	2.08	.....	.....	.....	.....	3.28						
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.15	.....	12.34
A	XIII.	XII.	XIV.	X.	X.	XV.	IX.	XV.	XIII.	XII.	IX.	XVI.
B	2.18	1.64	7.26	6.41	5.40	3.16	9.58	8.80	0.27	0.17	14.52	12.18
C	1.92		6.91		4.05		9.09		0.22		13.02	

TABLE V.—MILK OF WOMEN FROM 25 TO 30 YEARS OF AGE.

(Third lustrum.)

A = No. of cases above or below the general average.
B = Averages for A.
C = Averages for women from 25 to 30 years of age.
D = General averages for all ages.

No. of sample.	Albuminoids.		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
	Above av.	Below av.	Above av.	Below av.	Ab. av.	Bel av.	Above av.	Below av	Above av.	Below av.	Above av.	Below av.
13	2.40	.....	.....	6.45	6.01	.....	.....	9.07	0.22	.....	15.07	
14	2.52	.....	.....	6.44	4.95	.....	9.23	.....	0.27	.....	14.16	
47	4.86	.....	.....	5.40	.....	3.36	9.46	.....	.....	0.20	13.35	
8	2.15	.....	.....	6.51	.....	2.31	.....	8.94	0.28	.....	.....	11.40
67	.....	1.96	7.28	.....	4.74	.....	9.54	.....	0.30	.....	14.28	
32	.....	1.53	.....	5.84	5.62	.....	.....	7.21	.....	0.14	.....	12.99
24	.....	1.94	7.45	.....	.....	3.61	9.56	.....	.....	0.16	.....	13.02
9	2.05	.....	7.08	.....	.....	3.00	9.26	.....	.....	0.13	.....	12.31
66	...	1.11	7.07	.....	.....	2.73	.....	8.40	0.22	.....	.....	11.13
23	2.10	.....	.....	6.61	.....	4.02	.....	8.91	.....	0.20	.....	12.88
10	.....	1.45	7.19	.....	.....	2.11	.....	8.81	.....	0.19	.....	10.91
27	1.98	.....	7.00	.....	.....	2.44	9.19	.....	0.21	.....	.....	11.84
52	2.15	.....	.....	6.76	6.78	.....	.....	9.07	.....	0.16	15.89	
55	2.43	.....	.....	6.57	4.94	.....	9.27	.....	0.27	.....	14.20	
43	.....	1.50	7.32	.....	.....	3.77	.....	9.00	.....	0.18	.....	12.64
44	.....	1.49	7.31	.....	4.34	.....	.....	9.01	0.21	.....	.....	13.17
A	VIII.	VIII.	VIII.	VIII.	VII.	IX.	VII.	IX.	VIII.	VIII.	VI.	X.
B	2.58	1.62	7.21	6.32	5.34	3.04	9.36	8.71	0.25	0.17	14.49	12.23
C	2.10		6.77		4.04		9.00		0.21		13.08	
D	1.995		6.936		4.131		9.137		0.201		13.267	

This research affords no adequate data as to the rate of decrease beyond the age of 30 years. The only complete analysis bearing upon this point is that of the milk of a dark-haired, black-eyed swarthy Pole, of gross habit and enormous breast development, who, at the age of 33 years, had been the mother of nine children. Two ounces were drawn from the right breast only, five hours after previous nursing. It was low in specific gravity, and yellow in color. It contained:—

	Per cent.
Albuminoids	2.24
Sugar	6.25
Fat	2.76
Solids not fat	8.84
Ash	0.35
Total solids	11.45

III. *Period of Lactation, etc.*—If we divide this period into four intervals, the first extending from the beginning of lactation to the eleventh day after; the second from the eleventh to the thirty-first day; the third from the thirty-first to the ninety-first day; the fourth from the ninety-first day to the tenth month of lactation, we shall note the following changes:—

Albuminoids are greatest in the first interval, being 2.32 per cent. In the second, they exceed the general average, being 2.09 per cent. In the third interval they fall as much below the average as in the first they exceeded it, remaining at a low figure during the rest of lactation.

Sugar is least immediately after parturition and much below the average, whilst it is above and nearly constant during the three remaining periods.

Fat, like the albuminoids, is much in excess of the general average immediately after parturition, being 4.93 per cent. After the eleventh day it falls, being only 3.97 per cent.

The saline constituents are nearly constant during all stages of lactation, although slightly in excess during the first ten days.

The sum of solids not including fat does not vary greatly. Its amount in the first interval is 9.15 per cent., the general average being 9.14.

Interval since Nursing.—Nearly all the samples were drawn two hours after nursing, but certain ones, more especially Nos. 18, 32, 33, 39, were drawn immediately. In fat, albuminoids, salts, and total solids, they were in excess of the general average.

TABLE VI.—MILK OF WOMEN FROM FIRST TO ELEVENTH DAY OF LACTATION.

A = No. of cases above or below the general average.
B = Averages for A.
C = Averages from the first to eleventh day of lactation.
D = General averages from the 1st to 270th day of lactation.

No. of sample.	Day.	Albuminoids		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
		Above av.	Below av.	Above av.	Below av.	Above av.	Below av.	Above av.	Below av.	Above av.	Below av.	Above av.	Below av.
13	1	2.40	.....	.....	6.45	6.01	.....	.....	9.07	0.22	.....	15.07	
14	1	2.52	.....	.....	6.44	4.95	.....	9.23	.....	0.27	.....	14.16	
7	2	3.12	.....	.....	6.47	5.49	.....	9.91	.....	0.32	.....	15.35	
47	2	4.86	.....	.....	5.40	.....	3.36	9.46	.....	.....	0.20	13.35	
6	2	.....	1.45	7.24	.....	.....	3.20	.....	8.93	0.24	.....	.....	12.10
38	2	.....	1.82	6.96	.....	.....	3.97	.....	8.97	.....	0.19	.....	12.87
15	3	2.18	.....	.....	6.75	.....	2.84	.....	9.06	.....	0.13	.....	11.88
40	3	.....	1.75	.....	6.94	.....	3.68	.....	8.97	0.28	.....	.....	12.52
64	3	2.00	.....	.....	6.69	.....	3.96	.....	9.01	0.32	.....	13.05	
8	4	2.15	.....	.....	6.51	.....	2.31	.....	8.94	0.28	.....	.....	11.40
16	5	.....	0.85	.....	5.50	6.16	.....	.....	6.57	0.22	.....	.....	12.73
45	5	2.33	.....	7.48	.....	.....	2.47	9.97	.....	.....	0.16	.....	12.36
67	5	.....	1.96	7.28	.....	4.74	.....	9.54	.....	0.30	.....	14.28	
18	6	3.95	.....	7.92	.....	4.37	.....	12.09	.....	0.22	.....	16.55	
41	6	2.45	.....	.....	6.08	.....	3.82	.....	8.72	.....	0.19	.....	12.41
21	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.01
32	10	.....	1.53	.....	5.84	5.62	.....	.....	7.21	.....	0.14	.....	12.99
34	10	2.19	.....	7.46	.....	6.89	.....	9.90	.....	0.25	.....	16.66	
A		XI.	VI.	VI.	XI.	VIII.	IX.	VII.	X.	XI.	VI.	VIII.	X.
B		2.74	1.56	7.40	6.28	5.53	3.29	10.01	8.54	0.26	0.17	14.81	12.43
C		2.32		6.67		4.93		9.15		0.23		13.48	
D		1.995		6.936		4.131		9.137		0.201		13.267	

TABLE VII.—MILK OF WOMEN FROM THE 11TH TO 31ST DAY OF LACTATION.

No. of sample.	Day.	Albuminoids		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
		Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Above av.	Below av.
33	11	2.24	.....	.....	6.25	.....	2.76	.....	8.84	0.35	.....	.....	11.45
65	12	2.25	.....	7.12	.....	5.85	.....	9.52	.....	.....	0.15	15.35	
26	13	2.08	.....	6.98	.....	.....	3.28	9.26	.....	.....	0.20	.....	12.39
4	13	.....	1.73	7.25	.....	.....	2.95	9.19	.....	.....	0.18	.....	11.96
39	13	2.33	.....	.....	5.78	4.21	.....	.....	8.32	0.21	.....	.....	12.57
29	17	.....	1.81	.....	6.88	.....	2.80	.....	8.89	.....	0.20	14.69	
48	17	.....	1.93	.....	.....	5.59	.....	.....	9.06	.....	0.18	14.58	
28	19	2.23	.....	7.39	.....	.....	2.95	9.83	.....	0.21	.....	.....	12.95
31	19	2.27	.....	.....	6.75	5.96	.....	9.17	.....	.....	0.15	15.21	
24	20	.....	1.94	7.45	.....	.....	3.61	9.56	.....	.....	0.16	.....	13.02
9	22	2.05	.....	7.08	.....	.....	3.00	9.26	.....	.....	0.13	.....	12.31
51	23	2.42	.....	6.95	.....	5.60	.....	9.56	.....	.....	0.19	15.25	
68	23	2.17	.....	7.44	.....	4.36	.....	9.90	.....	0.29	.....	14.26	
3	25	.....	1.96	7.31	.....	4.62	.....	9.45	.....	.....	0.18	13.96	
5	26	.....	1.49	7.23	.....	.....	2.12	.....	8.90	.....	0.18	.....	11.11
60–3	26	.....	1.95	7.02	.....	.....	3.85	9.19	.....	0.22	.....	.....	13.12
2	27	.....	1.68	7.53	.....	.....	3.55	9.42	.....	0.21	.....	.....	12.84
30	27	2.11	.....	7.41	.....	5.04	.....	9.72	.....	.....	0.20	14.69	
35	29	2.43	.....	7.34	.....	.....	3.13	9.98	.....	0.21	.....	.....	13.20
66	30	.....	1.11	7.07	.....	.....	2.73	.....	8.40	0.22	.....	.....	11.13
A		XI.	IX.	XVI.	IV.	VIII.	XII.	XIV.	VI.	VIII.	XII.	VIII.	XII.
B		2.23	1.76	7.22	6.42	5.02	3.23	9.50	8.74	0.24	0.17	14.75	12.25
C		2.09		7.06		4.00		9.27		0.201		13.25	
D		1.995		6.936		4.131		9.137		0.201		13.267	

TABLE VIII.—MILK OF WOMEN FROM THE 31ST TO 91ST DAY OF LACTATION.

No. of sample.	Day.	Albuminoids		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
		Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Above av.	Below av.
12	41	.....	1.76	6.97	.....	.....	2.44	.....	8.93	.....	0.20	.....	11.40
1	45	.....	1.44	7.20	.....	5.58	.....	.....	8.81	.....	0.17	14.46	.....
17	49	.....	1.49	7.37	.....	5.02	.....	.....	903	.....	0.17	14.18	.....
11	18	.....	1.98	6.99	.....	.....	3.06	9.17	.....	.....	0.20	.....	12.21
20	50	.....	.....	.. ..	.....	.....	.....	.....	.....	0.30	.....	14.08	.....
23	53	2.10	.....	.....	6.61	.....	4.02	.....	8.91	.....	0.20	.....	12.88
10	82	.....	1.45	7.19	.....	.....	2.11	.....	8.81	.....	0.19	.....	10.91
53	88	.....	1.82	.....	6.83	4.28	.....	.....	9.02	0.37	.....	13.30	.....
27	89	1.98	.....	7.00	.....	.....	2.44	9.19	.....	0.21	.....	.....	11.84
52	90	2.15	.....	.....	6.76	6.78	.....	.....	9.07	.....	0.16	15.89	.....
A		III.	VI.	VI.	III.	IV.	V.	II.	VII.	III.	VII.	V.	V.
B		2.07	1.66	7.12	6.73	5.41	2.81	9.18	8.94	0.29	0.18	14.38	11.85
C		1.60		6.99		3.97		8.99		0.22		13.11	
D		1.995		6.936		4.131		9.137		0.201		13.267	

TABLE IX.—MILK OF WOMEN FROM THE 91ST DAY TO THE 10TH MONTH OF LACTATION.

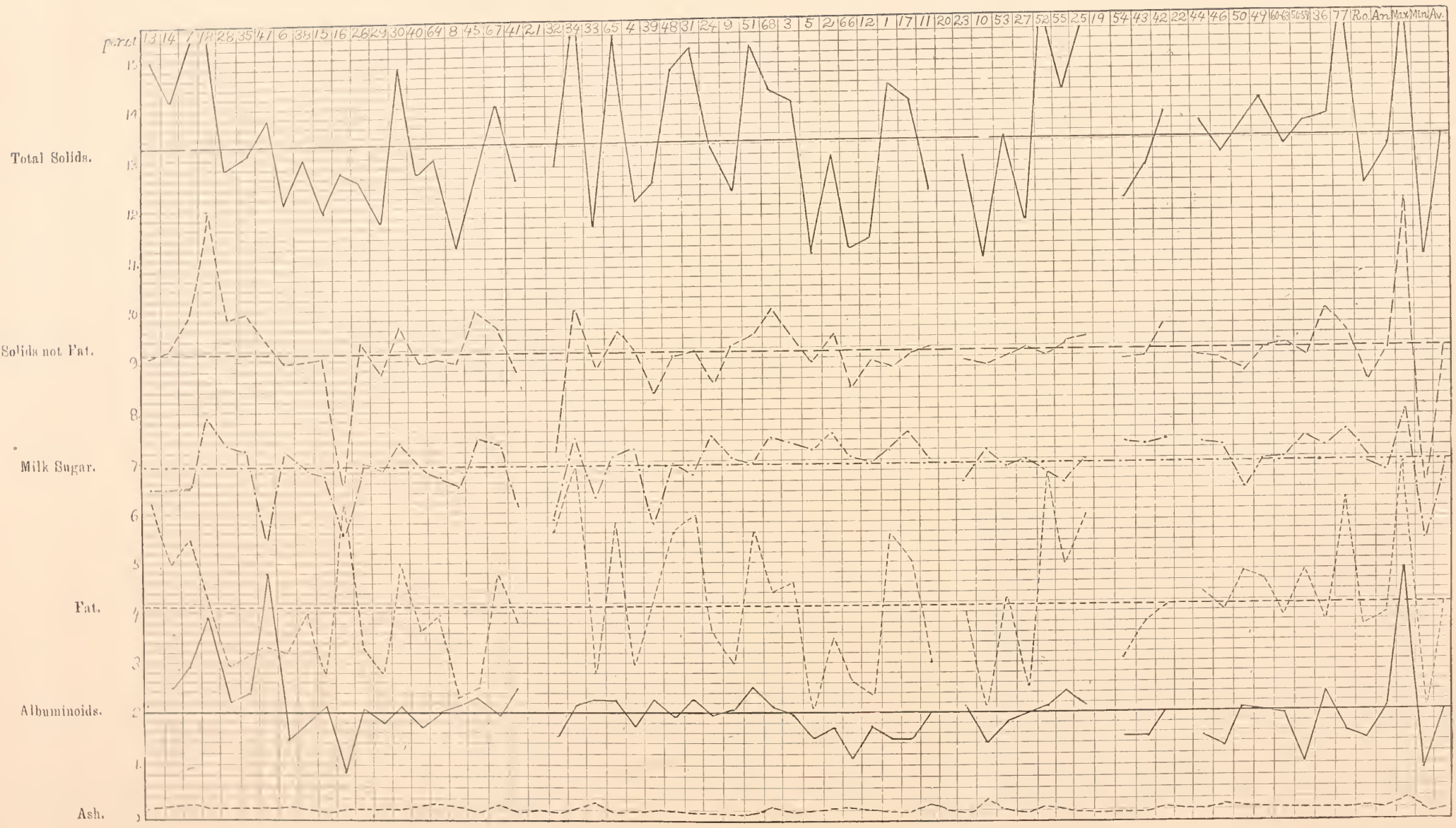
No of sample.	Day.	Albuminoids		Milk-sugar.		Fat.		Solids not fat.		Ash.		Total solids.	
		Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Ab've av.	Bel'w av.	Above av.	Below av.
55	93	2.43	.....	.....	6.57	4.94	.....	9.27	.....	0.27	.....	14.20	
25	115	2.16	.....	7.00	.....	5.84	.....	9.38	.....	0.22	.....	15.18	
19	126	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.15	.....	12.34
54	132	.....	1.50	7.34	.....	.....	3.10	.....	8.92	.....	0.18	.....	12.12
56–9	136	.....	1.16	7.41	.....	4.79	.....	.....	8.78	0.21	.....	13.63	
43	150	.....	1.50	7.32	.....	.....	3.77	.....	9.00	.....	0.18	.....	12.64
42	167	.....	1.97	7.38	.....	4.16	.....	9.60	.....	0.25	.....	13.60	
22	180	.....	.....	.....	.....	.....	.....	.....	.....	0.21	.....	.....	12.74
44	180	.....	1.49	7.31	.....	4.34	.....	.....	9.01	0.21	.....	.....	13.17
46	186	.....	1.35	7.24	.....	.....	4.09	.....	8.89	0.30	.....	.....	13.15
50	217	2.06	.....	.....	6.39	4.75	.....	.....	8.67	0.22	.....	13.48	
49	270	2.00	.....	6.95	.....	4.64	.....	9.16	.....	0.21	.....	13.74	
A		IV.	VI.	VIII.	II.	VII.	III.	IV.	VI.	IX.	III.	VI.	VI.
B		2.16	1.50	7.24	6.48	4.78	3.65	9.35	8.88	0.23	0.17	13.97	12.69
C		1.78		7.09		4.44		9.07		0.22		13.34	
D		1.995		6.936		4.131		9.137		0.201		13.267	

IV. *Nationality.*—The statistics are entirely too meagre to determine the influence of nationality. It would be necessary to obtain for each race a large collection of results, in which the other causes of variation, like age, period of lactation, etc., were allowed for or eliminated. This has never been done, and would require, not eighty, but many hundred analyses.

The difficulty of generalization upon these points can be most forcibly illustrated by comparing the analysis of sample No. 40, which was obtained from a negress, with the other samples, and with the general average. Neither in color, smell, nor other physical characteristics, nor in chemical constitution, was this one sample so markedly different from the others as to be put, as some have proposed to do with the milk of negro women, in a class by itself.

V. *Physical Constitution of the Mother.*—A comparison of the physical characteristics of the mother,

To face p. 259.


per cent
Total Solids.
Solids not Fat.
Milk Sugar.
Fat.
Albuminoids.
Ash.
13 14 7 28 35 41 6 38 15 16 26 29 30 40 64 8 45 67 41 21 32 34 33 65 4 39 48 31 24 9 51 68 3 5 2 66 12 1 17 11 20 23 10 53 27 52 55 25 19 54 43 42 22 44 46 50 47 60-63 56-59 36 77 Ro. Av. Max Min Av.

whether blonde or brunette, or more minutely, as to color of eyes, hair, complexion, etc., has not shown that these differences are necessarily related to corresponding differences in the composition of the milk. But actual differences in the physical condition of the mother are intimately related. The samples obtained from women of over-robust habit were not so rich in albuminoids as those from pronouncedly anæmic women; and, generally speaking, the best milk was obtained from lean women in good physical condition.

Graphic Chart.—A great deal of labor was devoted to the preparation of a graphic chart of the results of the analyses performed during the course of the present investigation. It was thought that the study of such a chart might reveal some law governing the relative amounts of the various constituents, which law might escape notice in comparing merely tabulated figures. The chart represents the results grouped according to the period of lactation, and follows the same order as that of Table I. In case, however, a number of samples were obtained from the same mother on different dates, these analyses are represented consecutively. These exceptions to the general order of arrangements are to be noted in samples 7, 18, 28, and 35, in samples 15, 16, 26, 29, and 30, and in samples 1 and 17. The horizontal lines in the chart represent differences of one-fifth of one per cent.; the vertical columns represent the sample analyzed.

One feature the chart exhibits in the most striking manner, and that is the great variability in the constitution of women's milk. The proportion of fat more especially varies in an exceedingly arbitrary

manner. But as to any fixed and definite relation governing the proportion of the constituents to each other, or to the sum total of the solid constituents, the graphic chart thus far has failed to afford a satisfactory indication.

[After the reading of the preceding paper:—]

Dr. ARTHUR V. MEIGS said: It has been a gratification to the other Fellows of the College, I am sure, as it has been to me, to listen to Dr. Leeds's paper upon this very important subject. The necessity for arriving at an exact knowledge of the composition of human milk becomes evident when it is remembered that more than one-quarter of all the deaths in Philadelphia during the year 1883 were of children under two years of age (*Public Ledger*, Jan. 1, 1884). A very large number of these deaths could have been prevented if the unfortunate infants had been differently fed. The day must come when the public will be better informed as to what should constitute the dietary of young infants; they will surely learn some day that pork and cabbage with soggy potatoes are not fit articles of food for children under two years of age, or, if no improvement in this matter is to be hoped for, we should now give up all our modern beliefs in the importance of educating the masses, and let them relapse hopelessly into the slough of ignorance in which they wallowed in the Middle Ages. The first step toward this end is for physicians to acquire an understanding of what is universally acknowledged to be the best food for infants—human milk. That this question is not yet settled becomes plain when we examine the various analyses of different authors, and that milk cannot be so variable a substance as these analyses would seem to show must be evident to any one who will reflect upon the subject. I will not now occupy the time of the College by giving my reasons for thus asserting milk to be a substance having a nearly constant composition, but will refer any one who is interested in the subject to a paper which I read before the County Medical Society in December last, and which was published in the *New York Medical Journal*, Jan. 19, 1884, and in the *Medical and Surgical Reporter*, Feb. 16 and 23, 1884. The conclusion seems to me a foregone one that milk is not so variable in its composition as might be supposed, but this has not been proved, or, at any rate, the proof has not yet been accepted, or else it might be said to be possible that no one of the existing analyses is correct, and the true one is still to be found. It might have been possible perhaps to more intelligently discuss Dr. Leeds's paper if I had had some knowledge beforehand of his conclusions

and how he arrived at them, but in the absence of such knowledge the subject can only be approached in a general way. The conclusions I announced in my paper previously mentioned I shall recede from only if some flaw in my premises can be shown, for the reasoning from the premises cannot be impugned, or, on the other hand, if Dr. Leeds has offered conclusions with proof so overwhelming that there can be no escape from accepting his results. To attempt much discussion of an elaborate scientific paper after merely hearing it read is a degree of rashness of which I do not feel myself capable. I may say, however, that in the matter of the separation of the fat, Dr. Leeds in testing my method did not follow exactly my directions. The vessel should not be shaken after the first portion of ether containing fat is removed with the pipette, but the ether poured on and then drawn off without agitation. I cannot say what might be the result if it were agitated five times, but that the fat as I obtained it was pure I am satisfied, for I have tried redissolving in ether after evaporation, and in each instance it was taken up perfectly. As for the word casein I used it in its commonly accepted sense to mean all nitrogenized portion of the milk. With regard to the criticism of the use of a pipette, I do not think its use could introduce any appreciable error. Dr. Leeds misquotes me when he says I advised that the first portion of milk be evaporated in the water-bath for only three hours. I said the drying must be continued until the residue ceases to lose weight, and that this sometimes takes much more than three hours. The statement that the albuminates are partially soluble in water is true of them as they are found in milk, but they entirely lose this solubility after being thoroughly dried at 100° C., and upon this fact depends the whole accuracy of my process.

My own observation has shown me the truth of what the author of the paper to-night has remarked, that the color of milk is no criterion of its richness or purity in fat. Often the palest milk contains the largest amount of fat, and *vice versâ*, that which has a very yellow color only a very small amount. The fat, after it is separated, presents great variability in color, being sometimes yellow like rich butter, and again as pale as melted white wax. The time at which a sample of milk is obtained from a woman for analysis is a matter of great importance, for if the milk is drawn when the child has not been nursed for many hours it will be found

to be very poor in fat, while, on the other hand, if it is taken after the breast has been nearly emptied by the child, it will be found to be rich in fat. I obtained two samples of milk from a woman under opposite circumstances as mentioned, and while one contained less than one per cent. of fat, the other contained seven.

CHOLECYSTOTOMY; WITH A REPORT OF TWO NEW CASES, A TABLE OF ALL THE HITHERTO REPORTED CASES, AND REMARKS.

By

J. H. MUSSER, M.D.,

CHIEF OF THE MEDICAL DISPENSARY OF THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA,

AND

W. W. KEEN, M.D.,

PROFESSOR OF SURGERY IN THE WOMAN'S MEDICAL COLLEGE OF PHILADELPHIA, SURGEON TO ST. MARY'S HOSPITAL, PHILADELPHIA.

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Case I. Reported by Dr. Musser. *History of biliary calculi of five years' duration; jaundice for eight months; symptoms of obstruction; attempted cholecystotomy; recovery.*—L. S., æt. 32, male, a native of Germany, and resident of West Philadelphia, a watchmaker by occupation, came under my care in Nov. 1881, for hepatic colic; of bilious temperament and sedentary habits, addicted to the use of malt liquors and tobacco in moderation, he was always healthy until the attacks began, from which his present condition developed. He had never had syphilis or malaria, and there is no evidence of diathetic disease or hepatic trouble in his family history.

The first intimation of hepatic trouble was five years ago (1876). At that time he had a severe attack of biliary colic followed by jaundice. Thenceforth he was always subject

to pain in the right hypochondrium, especially when sitting awhile or stooping; occasionally he had attacks of colic, but jaundice did not recur until the fall of 1881. During the spring and summer of that year he was very "bilious," on account of which he went to Europe. He was there told that he had an enlarged and hardened liver, and an enlarged spleen. In September he returned, and shortly after had a severe attack of biliary colic with jaundice. From that time until his visit in November, he had several attacks, and was continuously more or less jaundiced.

Nov. 7, 1881. At this date his skin was of an intensely lemon-yellow hue, his conjunctiva and the mucous membranes discolored. He suffered much from itching, and was depressed in spirits. His pulse was slow and feeble; his tongue was heavily coated with a yellow-white fur; his appetite good; his digestion slow and painful. The epigastrium was a little tender on pressure, and always the seat of slight distress. Flatulence was marked, constipation the rule, with passages hard and pipe-clay colored. Urine contained bile-pigment. Ordered ac. nitro mur. dil. gtt. xv, t. d. and Carlsbad water, fasting. He had just recovered from an attack of colic.

Further study of the notes from this time until the 23d of March, 1882, reveals, among other things, that his attacks of colic recurred, but at longer intervals, that his jaundice and dyspeptic symptoms improved, but never fully abated, that on account thereof he lost flesh. It appears that the only drug that gave him relief was the chloride of ammonium in large doses.

It was noted on March 23, that S. had had daily attacks of colic for the past two weeks, that the jaundice grew deeper, the body rapidly emaciated, and the gastro-duodenal symptoms recurred. During the past three days the pain was severe, lancinating, in the upper half of the abdomen, almost constant, associated with tenderness in the epigastrium and right hypochondrium, with enlargement of the gall-bladder.

The tumor was observed one inch below the margin of the ribs in the right hypochondrium, dull on percussion, hard, tender, and not fluctuating; on palpation, about the size of an egg.

March 26. Chill in the morning and a rise of temperature to 102° in the evening. Jaundice deeper; pain relieved; great local tenderness and marked induration in the epigastric area. Stools light and offensive; flatulence.

27*th*. Chill 11 P. M. 4 P. M. temperature 103°. Night sweats. Pain relieved until 8 P. M.; then very severe, with vomiting, great exhaustion following.

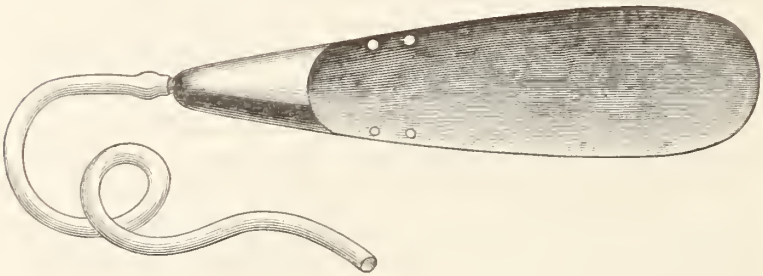
28*th*. Pain better; passages thin and more bilious; flatulence excessive; epigastric tenderness relieved; urinates very freely.

30*th*. No pain or fever. Dr. Pepper, in consultation, confirmed diagnosis of biliary colic, with probable impaction of calculus.

May 1. Dr. Keen was called in consultation. Bronzed yellow hue of face, lemon-yellow of trunk and limbs; emaciated, very weak; gastro-intestinal symptoms about same; nausea and vomiting marked; feces darker; epigastric tenderness; flatulence not marked. On deep percussion in nipple line, liver dulness begins in fifth interspace, on superficial at sixth rib, and extends to one-half inch below margin of ribs; in axilla, from eleventh rib to margin; in epigastrium dulness and some resiliency from xyphoid cartilage to an inch above the umbilicus. This area of dulness extends to the sloping edges of the ribs, both to the right and the left of the median line. Splenic dulness from eighth rib to lower border of ribs. Pulse 64, small and not strong; respirations 22. Chill at 1 P. M. 7.30 P. M., temperature 100.5°; pulse 96; bowels opened, feces darker; urine, sp. gr. 1028, the color of porter, free from albumen or sugar, urea about normal amount. On standing a large deposit settled, which proved to be phosphates in excess, and amorphous matter. Bile acids and bile pigment found in abundance.

2*d*. Condition about as previously noted, though free from fever or pain. In good spirits.

3*d*. Cholecystotomy attempted. Ether given by Dr. Sheppard, taken well. Strict antiseptic precautions observed, including the spray (carbolic acid). An incision three inches long was made from near the linea alba, parallel to the border of the ribs, one and one-half inches below them, to the right. In penetrating to the abdominal cavity the only large vessel cut was the superior epigastric artery, but five others were controlled temporarily by forceps, and tied before the belly was opened, at which time all bleeding had ceased. Two fingers being introduced and the exploration not being satisfactory, for but little could be learned, the incision was extended until it was 5½ inches long, of which 2 inches were to the left of the linea alba. A large nickle-plated tongue spatula made a capital retractor, holding ribs and liver both out of the way. The intestines were best held out of the way by an instrument Dr. Keen had had made. It was of German silver, and in shape not unlike a cricket-bat, the blade of which was slightly curved from



side to side, and the handle was hollow, with a rubber tube slipped over its end. The idea Dr. Keen had in mind was to depress the intestine with it and at the same time slip it under the gall-bladder, where it would serve as a conduit to carry off its contents and prevent their escaping into the abdominal cavity. Its length was 9 inches, and the blade 2¼ inches wide.

The liver was dark in color, not enlarged, and not softened to any extent save in the left lobe, which was both enlarged and softened, so that at first Dr. Keen almost thought there was an abscess in it. The colon was completely defined, and found to be adherent to the liver. On further and deeper exploration a hard mass, as large as the fist, was discovered attached to the liver, the colon, and the small intestine. The gall-bladder was included in this inflammatory mass, it was believed, as it could not be found at any other point. No gall-stone could be felt in the mass. At first, indeed, we were almost inclined to believe it a malignant growth. The diagnosis being so obscure it was decided to close the wound, especially as his circulation and respiration had both been very threatening more than once during the operation, so that a number of hypodermic injections of brandy had to be given. His pulse responded very quickly to each one of them. Ten wire sutures, including the peritoneum, were introduced. The operation lasted forty-five minutes. Drs. Pepper, Musser, and Roberts also examined the interior of the abdomen, their hands being first carbolized.

1.45 P. M. Put in bed in profound shock; hot bottles applied; hypodermics of brandy every ten or fifteen minutes; one-eighth gr. morphia by mouth.

7.30 P. M. Since 3 P. M. considerable pain; flatulence; morphia by mouth and hypodermically; pulse 84; respiration 24; temperature 95°.

4th. Reacted well and slept some in night. Wound in good condition. 10.30 P. M. Hemorrhage of ℥ij, due to capillary oozing.

5th. Chill at 6.30 P. M. One hour and a half later temperature 103.5°. Quinia in large doses with morph. Slight oozing of blood.

6th. Took 20 grs. quinia. Temp., 6 P. M., 100.8°; urinated well; takes food well.

7th. Sudamina marked. Hemorrhage—℥ij to ℥iij—from

pouting subcutaneous tissue between sutures and from suture points.

These hemorrhages were marked during the progress of the case. Thus they occurred daily until the 21st of the month, then every third or fourth day until June 1st. Any point of puncture, the removal or insertion of a suture, the opening of any abscess or the removal of any support from granulations—these and other most trivial things were sufficient to excite the flow of blood. At times they amounted only to oozings, again to free flowings—one so profuse as to cause collapse, others of ℥iij and ℥iv. Pressure and Monsel's solution generally controlled them. One was so profuse from a hidden point in an abscess pocket that opening of the wound was seriously considered.

From the 6th to the 8th of May the temperature did not rise above norm. The latter day it was 102°, and on the 9th it was found to be due to a small abscess in the wound, caused by disintegrating blood. When opened, this blood and some pus (ʒvj) were discharged. A probe passed into this cavity directly backwards into an apparently localized pocket within the belly cavity, for it was deeper than the thickness of the abdominal walls. The discharges, however, were always sweet. The temperature did not rise again until the 17th, although the abscess pocket discharged pus, and there was breaking down from nearly all the old stitches from the 8th. The afternoon rise of the 17th, 18th, 19th, and 20th (102°) was no doubt due to an inflammation of the lymphatics. On the latter day two red lines were traced from the pus pocket in the wound to an enlarged and tender gland in the right axilla. The lymphatic vessels, enlarged to the size of the little finger, were very hard, red, and painful at first. They finally softened, suppuration took place, and they were opened June 1st at the border of the axilla, discharging abundant thick pus. They continued to discharge until the latter part of the month. The last four days of the month the temperature again ran up to 101½–102° in the evenings, on account of the lymphatic trouble

and the formation of small abscesses in the skin and cicatrix. Sinuses formed from the latter, but were well drained by horse-hair. The temperature was always kept in control by quinia.

The wound apparently united by first intention, but the development of the numerous abscesses broke down any line of union, and several pockets had to heal by granulation. The first suture was removed May 9th, three on the 10th, and others at different days, the last being on the 16th. On the 10th a piece of rubber tubing was introduced into the large cavity above noted.

The wound was dressed daily, and often twice or thrice daily, antiseptically, until May 25th, twenty-one days after operation. Thereafter zinc ointment was applied. Mercurial ointment at first, and afterwards poultices, were used on the inflamed lymphatics.

Forty-five days after the operation the patient was out of bed, and on the sixtieth day he was out driving. During all this time, in addition to the surgical treatment, tonics were exhibited freely, and a most liberal and stimulating, but easily digested, dietary allowed. No attention was paid to the treatment of hepatic symptoms, and, in fact, they remain about *in statu quo*, although the feces darkened somewhat, the complexion partly cleared up, and the urine became clearer. Of course, the general strength improved, as did also the appetite and digestion. It is important to note that there was never any evidence of general peritonitis.

The above notes, appertaining chiefly to the surgical treatment of the patient, end July 1, there being one small granulating surface on the wound at that time. In recurring to the medical condition it may be said that, although the jaundice and the symptoms thereof remained stationary, yet there never was any paroxysmal pain since forty-eight hours prior to the operation. At this date (July 1, 1882) the color of the skin of S. was certainly lighter; the liver dulness on physical examination was found to extend from the fifth rib to the margin of the ribs in the nipple line, and to measure

five inches in the axillary and five and one-half in the scapular line. The indurated area extended four inches vertically from the xyphoid cartilage, was dull on percussion and tender on palpation; the appetite was good; flatulence great; the bowels regular. Along with tonics he has been taking an anti-fermentative pill after meals, and ammon. mur. gr. v, four times daily. One week ago put on succinate of soda at the suggestion of Dr. Bruen.

July 17. Condition about the same. Bowels inclined to be constipated; feces were more yellow. The succinate of soda acted so freely on the bowels that the amount had to be reduced to one pill daily, and finally the drug had to be discontinued. Natural costiveness was then relieved by Hunyadi water. This water, S. said, relieved him of a constant sense of fulness and weight of pain in the right hypochondrium.

27*th.* Five days ago took considerable exercise, followed the next day by pain, swelling, and tenderness in the epigastrium. With rest and counter-irritation it was relieved in seventy-two hours, but since then a dull pain has remained.

Aug. Since operation treatment quite unsatisfactory. For some ten days past has taken three grains potass. iodid. before breakfast, in a pint of water. His general condition, his appetite, and his digestion improved, but the jaundice remained, the skin, the urine, and the feces bearing evidence of it. The itching of his skin, however, had ceased entirely. He went to Saratoga toward the end of August.

At Saratoga, S. drank of the Hathorn spring-water, four to eight glasses daily, and followed a regulated diet. During his sojourn he gained in flesh and strength; the bile staining was entirely removed from the tissues; the gastro-intestinal and hepatic functions regained their normal power; the urine cleared up; his liver diminished in size; the mass in the epigastrium was not changed. He has been under observation ever since then, and has been in perfect health, save a slight attack of his old pain, followed by slight jaundice, in the spring of 1883. Otherwise he has had no com-

plaint save inconvenience, at times pain, on account of the induration. It especially annoyed him when working in a sitting posture.

Before closing this record there are two other facts worthy of mention. S. observed that, three or four hours before the attacks of pain began, he became quite deaf, with a subjective, dull sensation, and at times ringing in the ear, especially the left—a condition which only ceased some hours after the attack. He noticed also that over-indulgence in food, or the eating of too rich food, generally produced an attack. Exposure to cold and dampness was also an exciting cause.

Remarks.—From the first it was evident that the jaundice was of an obstructive nature, and that it was due probably to a calculus, which time and again advanced and receded, and finally probably became impacted in the ducts. The age, the sex, and the habits of the patient, the absence of a cause for such jaundice, the slight change in the size of the liver, the intense itching, the long continuance of the discoloration, and the intermittence in its intensity, all opposed the diagnosis of so-called jaundice from suppression; while the duration, the variability of the symptoms, notably the jaundice, the character of these symptoms, the enlarged gall-bladder discovered by physical examination, along with his sedentary occupation, and his temperament, supported the idea that the obstruction was due to a gall-stone. With these particulars, and the absence of emaciation until shortly before the operation, of cachexia, and of ascites, carcinoma, either of the liver or any other abdominal organ, was excluded. Catarrhal jaundice alone was weighed, with some degree of hesitancy, before eliminating it in the diagnosis.

It may be asked if all this trouble were from a stone, what became of it? how did a cure take place? what is the present enlargement in the epigastrium due to? The stone either was passed per anum unnoticed, in spite of the fact not mentioned in the notes, that for two weeks before and six weeks after the operation each passage was critically examined with a sieve and water; or, becoming impacted, the bile escaped around it, or it ulcerated into and now is imbedded in plastic matter. In either case the course of waters aided in resolving the accompanying catarrh of the ducts. The epigastric tumor is due to the collection of inflammatory material matted with the upper abdominal contents.

CASE II. *Acute Gastro-Intestinal Catarrh followed by Jaundice both becoming chronic; symptoms of Internal Suppuration; enlarged Gall-Bladder; Cholecystotomy; temporary relief; Death; Autopsy.* Reported by Dr. Musser.—F. R. D., æt. 31, white, male, native and resident of Philadelphia. A man of exemplary habits, but on account of his occupation, travelling salesman, he was compelled to eat irregularly and hurriedly. Family history good. Previous health, save fevers of childhood, unusually good. No malaria or syphilitic history.

History of Illness prior to Examination.—From July to October, 1882, D. suffered from dyspepsia. Early in October of that year he was seized with a severe attack of acute gastro-intestinal catarrh characterized by vomiting and purging, with severe epigastric and abdominal pains, and with high fever. With the decline of the disease on the sixth day jaundice began. At first light-colored, it rapidly increased in intensity, so that in ten days he was almost of the present appearance. During the winter he attended to his business. The jaundice continued and was persistent in degree. He lost but little flesh, was of rather gloomy spirits, but not depressed in physical strength. His appetite

was good, voracious indeed, his stomachic digestion unimpaired. In addition to the jaundice and its symptoms, it is important to carefully note two symptoms: 1st, the occurrence of intestinal dyspepsia and a chronic diarrhœa; and 2d, of a constant source of pain or distension in the upper abdomen.

Regarding the first, the passages were uniformly loose, painless, putty-colored, and from six to ten daily. Of the second it may be noted that the pain was not influenced by exertion, but was worse when in the recumbent posture.

Condition at time of Examination.—April 23, 1883, countenance drawn, conjunctivæ deep yellow, skin of face of an olive hue; skin of trunk and extremities of a deep yellow, mucous membrane of mouth under tongue stained yellow, body not much wasted (loss estimated at 10 lbs.). On trunk and extremities numerous scratch marks, itching being very great. Complains also of flushes of heat, at times intolerable.

Alimentary Tract.—Tongue coated white, heavy yellow coating in the mornings; bitter taste in the mouth; good appetite; no marked dyspeptic symptoms; intestinal flatulence; colicky pains; diarrhœa; six to ten loose, putty-colored passages daily. Liver dulness from fifth interspace to one-half inch below margin in nipple line; left lobe not enlarged; tenderness on pressure along the hepatic margin; abdomen not distended; abdominal veins slightly enlarged; spleen normal size; no ascites.

Lungs and Heart.—Both normal: 1st sound of heart weak; pulse slow and rather feeble. In fourth interspaces a systolic retraction of chest wall noted.

Urine.—Normal amount, porter-colored, acid, sp. gr. 1024; no albumen or sugar, bile acids and pigment in abundance.

Mental faculties and special senses normal; no yellow vision. On account of pain and itching, sleep disturbed; very despondent. Placed on treatment without improvement.

May 10. Same, diarrhœa worse. Above umbilicus and to the right a soft swelling two inches in diameter. Between the hepatic dulness and the dulness of this mass, a space of resonance two inches broad. Œdema of feet.

The patient, his condition not having changed, gave up treatment, and was not seen until June 9th. Note of that day: Had been feeling unusually well for two weeks past. Had, however, on the 8th, a severe rigor at noon followed by high fever, and with both a severe headache. There was no pain in the afternoon; the following night he suffered from severe, lancinating pain in the abdomen, especially the upper half. Now (7 P. M. 9th) temperature 104°; pulse 120; extreme tenderness in epigastrium; to the right and above the umbilicus a large, round soft tumor tender on pressure. Liver and spleen enlarged.

June 10. Fever continued since yesterday; severe headache; constant pain in the epigastrium and left shoulder; after a severe paroxysm of pain had an epileptiform (?) seizure.

11*th*. 8 A. M. slow feeble pulse; respirations 20, irregular; a short, feeble inspiration and expiration, then a full, long, gasping inspiration and a prolonged sighing expiration. Abdomen is tympanitic and tender all over. Bladder empty; no urine passed in twenty-four hours. Though conscious, recognizing persons and being affected by emotion, was unable to talk or to swallow.

4 P. M. The above condition continued about eight hours. Vomited three times this P. M.; ejecta acid, dark-colored coffee ground, due to blood, as shown by microscopical examination; bowels opened; urinated.

12*th*. A. M., temperature 103½°; pulse 120; respiration hurried; skin dry; delirious; tongue dry; eats readily; bowels not opened; liver dulness in nipple line from fourth rib to two inches below margin; slight epigastric pain, marked tenderness.

13*th*. By 3 A. M. fever subsided. 8 A. M., severe rigor half an hour's duration followed by fever; urine clear; pulse

70; temperature 102°; respiration jerking; urine scanty, passed with difficulty. Bowels opened by purgation five times, fæces light-colored.

15*th*. Temperature 101°; pulse 96; urine more free, same chemical characters as before noticed with phosphates in addition; bowels opened, light-colored.

17*th*. Dr. Keen was called in consultation. Yesterday chill followed by fever and a profuse sweat. A few days ago he had a profuse hemorrhage from the nose; since then three small ones, and a constant tendency thereto. Physical examination shows liver dulness to be in the nipple line five and a half inches in extent vertically. The lower border is defined by a uniform curved line extending from a point an inch and a half above the right iliac spine to the ensiform cartilage. At the middle of its border a tumor projects towards the navel two and a half inches each way in diameter. It is round, soft, elastic, slightly tender, well defined to the finger, and semi-dull on percussion. It was tapped with a very short hypodermic needle, and ℥j of limpid viscid serum drawn off.

Dr. Leffmann, to whom the fluid was handed, reported that "chemical and microscopical examination gave no indication of bile constituents. Nitric acid gives a very faint green tinge, but is too indefinite to constitute a basis for supposing the presence of the bile color. The reaction is neutral, the liquid contains albumen, and the sediment shows many nucleated corpuscles much like those of pus." No hydatid hooklets were found.

19*th*. In accordance with the earnest request of the patient, cholecystotomy was done by Dr. Keen. Abdomen so tympanitic that no evidence remained of the roundish tumor felt and percussed on the 17th. Incision five inches long, one-half way between umbilicus and ribs, parallel with the latter, inner end just reaching the right rectus muscle. Slight bleeding; two vessels tied in the abdominal wall. Great trouble in keeping the distended bowels out of the

way. The special scoop (see Case I.) was invaluable, and both kept the bowels back and carried off the contents of the cyst. The pear-shaped gall bladder was at once seen as soon as the intestines were pushed away. It was tapped by a small trocar, and twenty ounces of the same fluid as on the 17th withdrawn. Opening then enlarged to admit two fingers, followed by a discharge of a few ounces of pus mixed with bile. Walls of gall-bladder one-fourth inch thick; bled but little. The finger felt nothing inside, and neither then nor before the opening could any gall-stone be found. A bullet probe, a Nélaton probe, and a stone forceps were each tried, both to find the stone, or, failing in that, to discover the aperture of the cystic duct. They all entered seven inches and moved freely in a large cavity. With probe in gall bladder, and hand in abdomen guiding it, the probe could not detect the cystic duct. The liver, aorta, and presumably the pancreas were all felt, but no cause of obstruction was evident. The cystic duct both of us thought we felt, and found thickened, but further nothing. The gall-bladder on being opened was kept under control, after emptying, by a wire ligature passed through the edges of the opening. Ether was used, and entire antiseptic precautions including the spray (carbolic acid).

The wound was closed by twelve sutures, six being used to attach the opening in the gall-bladder to the one in the abdominal wall, thus creating a biliary fistula. Antiseptic dressings with carbolized sponges under them, to catch the discharge, were used: a rubber fenestrated drainage tube inserted in the gall-bladder; borated cotton and muslin bandage outside. Exhausted by operation, but recovered nicely before evening. Passed water, dark as before. At first milk, lime-water, and brandy every half hour, later every two hours. 8 P. M., temp. 99.4°. Comfortable. One-eighth grain of morph. sulph. used once for pain. Dressings just saturated by discharge. Redressed; milk, etc., every two hours.

20*th*. Passed a fair night; temp. 99°; morphia, one-eighth grain once; but little pain. Dressings green with bilious discharge in moderate quantity; wound looks well; no pus, no inflammation; two drachms of blood from two stitches at one point on edge of wound. Redressed.

21*st*. Pulse good strength; dressings moderately saturated with bile, yellow in centre, green at edges. General condition not affected by operation; bowels tympanitic and confined; nose bled slightly; vomited blood afterwards.

22*d*. Quite comfortable except some hiccough; tympany still marked; dressing moderately wet with green and yellow bile; no pus; lower edge of wound found exposed by dressing being disarranged, but it was dry and apparently firmly united; no fever, temp. 99.2°. As bowels still confined, ordered ol. ricini by enema, and small doses of calomel every two hours. Redressed.

23*d*. No fever; temp. 99.2°; pulse 90, strong. Very uncomfortable from tympany; a small passage from enema lessened it slightly. Has vomited considerably when he takes food; hiccough occasionally; skin lighter color; biliary discharge more profuse; dressings saturated, yellow-brown in centre, green at edges. Wound looks well; no inflammatory redness; edges dry, except from biliary discharge mixed with some probably disintegrating blood, etc., from interior of gall-bladder; drainage tube free, but bladder somewhat filled with blood. Ordered to stop food by mouth and to take milk and brandy by rectum; 10 grains calomel and a pill of ext. colocynth, aloes, and ext. hyoscyamus by mouth, and a little iced champagne.

24*th*. Removed tubing for a few minutes and probed five inches into the gall-bladder. It seemed to be very much contracted in diameter, as compared with its size at time of operation. No stone found. His color is lighter; bowels slightly moved once; tympany very great. To take ox-gall and the purgative pills, and a high injection with turpentine and assafœtida. Had not vomited for twenty-four

hours, and hence to be fed by mouth frequently in small quantities.

25th. Wound appears in healthy condition. Dressing stained with blood and saturated in places with bile; no evidence of suppuration; abdomen still tympanitic. No sutures removed. Rise in temperature, last night 101°, to-day 12 M. 102°. Localized tenderness on pressure over lower abdomen not so marked as yesterday.

26th. Slight hemorrhage from wound during night; wound looked healthy this A. M. Patient has been sinking steadily since last night. Died at 12.30 P. M. of exhaustion.

Post-mortem by Dr. William E. Hughes (present, Dr. Musser, Dr. Hamill, and Mr. Dock), six hours after death. Rigor mortis well marked; tissues all bile-stained; subcutaneous fat lost to a great extent; internal organs partially undergoing decomposition. Brain not examined. *Thorax:* Heart muscle stained with bile pigment, soft, and had the appearance of fatty degeneration. Lungs œdematous posteriorly; a few adhesions between pericardium and lung, and pleuritic adhesions on right side behind. Glands in lower anterior part of thorax enlarged. *Abdominal cavity:* Intestine distended with gas; dark-colored; a small amount of ascitic fluid in peritoneal cavity; perfect adhesion of gall-bladder to abdominal wall, and perfect union of wound; some slight traces of lymph on transverse colon; about two ounces of recently-clotted blood in folds of gastro-colic omentum, red in centre, dark on periphery, and firm. Liver: Firmly adherent to diaphragm all over right and partly over left lobe; one and a half times natural size, occupying the position defined in life; color dark bottle-green. Gall-bladder about as large as the fist, with thickened walls and inflamed mucous coat, and containing bile. Ducts: Cystic dilated, almost thickness of lead pencil; at junction with gall bladder there seemed to be a honeycombed projection of the mucous membrane, thereby occluding the duct. Common duct enlarged, walls thickened, calibre increased enough to

admit forefinger at cystic duct, and at duodenum the thumb; walls thickened, mucous membrane inflamed; orifice impervious to blowpipe and to liquid; a small probe was forced through with some difficulty from the duodenum; the mouth of this, in common with the pancreatic duct, presented a knob-like projection a little larger than a split pea, on the mucous membrane of the duodenum, the walls of which were thickened; there was no evidence of ulceration or cicatrix. The hepatic ducts were dilated and inflamed in their ramifications through the liver, some terminating in blind pouches. In the periphery of the left lobe of the liver there were several retention cysts, the size of a filbert, filled with pus and bile; the tissue of the liver was very soft, olive-green colour, and had the appearance of disintegration; glands in fissure not enlarged; pancreas was normal, ducts dilated, and containing pancreatic fluid. The dilatation of the pancreatic duct was remarkable. The main duct was larger than the forefinger, while its subdivisions far into the gland were also enlarged. Stomach: Dilated, mucous membrane mammillated, and covered in some places with mucus; contents were blood and the liquids which had been administered. Duodenum: Mucous membrane thickened, swollen, appeared as if inflamed, although the rapid post-mortem changes made it difficult to discern ecchymosis or congestions. This appearance of the duodenum explained perfectly the reason of the obstruction at the mouth of the ducts. Kidneys: Enlarged, capsule readily removed; on section presented a slightly granular and mottled appearance. Spleen slightly enlarged. Microscopical examination of the liver tissue impossible, as decomposition had advanced too far.

Remarks.—When the patient first presented himself for treatment at the Medical Dispensary of the University Hospital the diagnosis of chronic catarrhal jaundice was made, based on the following reasons

given to the dispensary class. In the first place gall-stones were excluded on account of the age, sex, and habits of the patient, the absence of a tendency in the family to biliary colic, the absence of attacks of jaundice previous to this decided attack, the absence of true biliary colic, and the persistence of the jaundice. For almost similar reasons the presence of any other foreign body in the ducts was eliminated. Next, all causes of jaundice from pressure on the exterior of the ducts, as, for example, by carcinoma of the liver and other organs, were excluded on account of the absence of any physical signs of such disease, of any alterations in the function of these organs, and of any pressure symptoms produced thereby. Finally, in considering the causes of jaundice from disease of the duct walls, an adhesive inflammation of the mucous surfaces, the contraction of the cicatrix of a healed ulcer or of the adhesions of a peri-hepatitis, were excluded especially because there was nothing in the history to show that there had ever been such a pathological occurrence. It was obvious that the jaundice was due to inflammatory swelling of the duodenum or of the duct, because of the age and the habits of the man, his frequent exposure, his hurried, irregular, and enormous meals; the acute attack primarily; the continuance of gastro-intestinal dyspepsia; the persistence of the jaundice; the comparatively little emaciation; the slight and uniform enlargement of the liver; the heaviness and tightness in the epigastrium without pain, and the slight tenderness. The only symptom that did not make the diagnosis absolute was the occurrence of the diarrhœa.

It was remarked at the time that this complaint (diarrhœa) might be due to pancreatic disease—possibly malignant, with pressure on the biliary ducts. The autopsy proved, in part, the truthfulness of the supposition—the pancreas was affected from obstruction of its duct. The stools were not examined for fat.

The second time the patient was under observation, the anomalous symptoms of hectic and the severe pain rather made the first diagnosis uncertain. It was feared that there might be an impacted calculus setting up ulcerative inflammation of the ducts. No absolute cause could be fixed upon, and it was only definitely known that we had to deal with a case of obstruction, causing jaundice and enlargement of the gall-bladder; that on account of these three conditions, rigors and fevers, hemorrhages, and extreme exhaustion were produced; that all medical treatment was futile and that operative measures were justifiable.

The case merits two more remarks: First, from the occurrence of the diarrhœa and intestinal indigestion, as shown by flatulence and colicky pains several hours after eating, could we not localize the lesion in the hepatic duct? If they had been absent, then the lesion was in the duct beyond or internal to the junction of the common and pancreatic duct. Then, it is of importance to call attention to the results of blood-cell counting, aside from physiological or pathological reasons. No note is made in the clinical history of the case. The count made with a Mallassez instrument showed there were 4,350,000 red and

200,000 white cells to a cubic millimetre, or 1 white to 22 red. An increase in the white cells is thus noted, while the red corpuscles were small, crenated, and shrivelled. This is the all-potent factor in the causation of the hemorrhages, and a resort to a numerical estimate of the richness of the blood and to the size of the cells, might prevent an operation, which, if resorted to, might be fatal in all probability from hemorrhage.

Finally, the diverse character of the fluids evacuated is worthy of notice. Rokitansky says that in dilatation of the biliary passages and enlargement of the gall-bladder, a marked twist of the cystic duct takes place so that an acute angle is formed. On account of this, communication between the gall-bladder and the common duct is cut off, hence it was that the viscid serum of the former was not mingled with the bile and pus from the latter.

The following tables are made to include two classes of cases, viz: First, those in which the abdominal cavity alone was opened in order to relieve biliary obstruction; second, those in which cholecystotomy, properly so called, was done. Cases are not included in which the tumor, due to obstruction, was treated as an ordinary abscess, by cataplasms and free incision, with or without previous provocation of adhesions. Nor are any of the many reported cases of aspiration of the gall-bladder included in the analysis. The purpose of the table is to show the nature of the diseases and the results of treatment when abdominal section was systematically performed.

M. Morand, a contemporary of Petit, reports two

cases of tumor of the gall-bladder treated by opening of the abdominal wall.[1] He believes the proper mode of treatment is, to incise the belly wall and then allow the evacuation of the tumor to nature, encouraging it by poultices. Such cases are not included in the table. They are mentioned to show the difference between his method and the more common one, that is to open the tumor by free incisions which include the abdominal wall and gall-bladder. There are very many such cases on record, some of which will be referred to by Dr. Keen. Of such nature are those of Burke (*N. Y. Med. Rec.*, Nov. 10, 1883), reported as cases of cholecystotomy.

[1] Observations sur des Tumeurs à la vesicle du fiel. Par M. Morand, Mémoires de l'Académie Royale de Chir. Paris, 1758, iii.

TABLE I.—*Cases in which the abdominal*

No.	Date.	Reporter.	Source.	Sex	Age	Remote cause.	Condition at time of operation. General and special.	Duration. Present disease.
1	June 29, 1870	Hughes,	Cin. Lancet and Clinic, 1879–80, N. S., iii. 147.	F.	47	Gall-stones; duration only 2½ mos., to acute pain accompanying menses, not explicit.	Tumor, "hard and painful, reaching far down below floating ribs;" "feeling like enlargement and induration of liver." (No jaundice.)	7 weeks.
2	Jan. 22, 1878	Brown,	Brit. Med. Journ., 1878, ii. 916.	F.	45	Gall stones; "Angular gall-stones in cystic duct;" history for 6 years of hepatic colic.	Tumor in right hypochondrium, not lessened in size by drawing off f℥vi bloody pus. General condition very bad; failing for 3 months; no jaundice; bile in stools all the time.	1 year; tumor slowly increasing in size.
3	Feb. 4, 1878	Blodgett,	Homœopath. Times, N. Y., 1879–80, vii. 83.	M.	?	"Cancerous disease of pancreas involving gall-duct."	Cholæmic intoxication-coma at time of operation.	Under observation 2 months.
4	May 3, 1882	Musser and Keen,	Amer. Journ. Med. Sci., Oct. 1884, p. 333, and Trans. Coll. Phys., Phila. 1884.	M.	34	Gall-stones; subject to attacks for 5 yrs.	No perceptible tumor of gall-bladder. Dulness from xiphoid to level of 9th rib. Gall-bladder and colon had become imbedded in a mass of inflam. material. Patient deeply jaundiced and much emaciated—dangerously so.	Jaundice 9 months

TABLE II.—*Cases of*

No.	Date.	Reporter.	Source.	Sex	Age	Remote cause.	Condition at time of operation. General and special.	Duration. Present disease.
5	June 15, 1867	Bobbs,	Tr. Ind. State Med. Soc., 1868, p. 63–73.	F.	30	Gall-stone in cystic duct; history 4 years' duration.	Tumor on right side 4 years; growing rapidly for 6 months; "anæmic and sallow" (no jaundice).	4 years.
6	Apr. 18, 1878	Sims,	Brit. Med. Journ., 1878, i. 811.	F.	45	Gall-stones. For 1 year prior to last illness felt pain in hep. region on stooping.	Tumor in right hypochondrium. Jaundice. On March 17 aspirated and drew off 32 oz. dark, brown fluid, but no bile. April 19 same size. Emaciated, feeble, unable to eat or sleep.	Jaundice 6 months: tumor 4 months.
7	June, 1878	Kocher,	Cor-Bl. fur Schweiz. Aerzte, Basle, 1879, viii. 577–583.	F.	30	Gall-stones.	Supposed to have an ovarian cyst. The suspected tumor distended abdomen on right side, moved with respiration; movable on palpation, and smooth. Hepatic colic, two attacks. On aspiration a fluid color of pus, but only detritis and fat shown with microscope.	.....

Cavity, but not the Gall-bladder, was opened.

Diagnosis.	Condition shown by operation, etc.	Operative procedure.	Result.	Cause of death.	Remarks.
Tumor became so soft he thought it had suppurated, and explored with hypodermic needle.	Suppurative inflammation of gall-bladder; probable closure of cystic duct.	After exploring with needle opened with abscess lancet, and evacuated vi. oz. of pus, and in 2-3 days a gall-stone.	Pus was discharged for a few days, and wound closed; opened July 6, and spontaneously in Sept. Ultimate recovery.	.....	Adhesions of gall-bladder to abdominal wall.
Not positive, but in favor of enlarged gall-bladder.	Distension of gall-bladder from closure of cystic duct caused by impacted stone; "pericystic abscess" which was aspirated Jan. 6.	Incision through abd. walls; found tumor to left of umbilicus, that aspirated being from an abscess in omentum; became alarmed and sewed up wound. Next day "something burst, and I pint of bilious fluid escaped."	Walked out in 1 mo but 1 wk. later the tumor formed again, and opened externally. Well in 3 months.		
Distension of gall-bladder from causes named.	No information as to gall-bladder (see "Remote Cause") except that aspiration evacuated "iv. oz. thick, brown fluid."	Having aspirated twice, cut down, emptied gall-bladder without incising it, and fastened to abdominal walls; some union.	Death on 3d day.	Exhaustion and cholæmia.	Very imperfectly reported.
Impacted calculus.	Gall-bladder could not be found, but thought to be included in a mass of inflam. material between colon and liver; no gall-stone could be found.	Abdomen opened, but the condition being as described in preceding columns, it was closed up. Hemorrhage marked all the time, and threatening death sometimes.	Recovery after two months of slow and uncertain convalescence	.....	Repeated hemorrhages.

Cholecystotomy, properly so called.

Diagnosis.	Condition shown by operation, etc.	Operative procedure.	Result.	Cause of death.	Remarks.
None. The operation was largely exploratory, and at desire of patient.	Cystic duct closed by a stone. Gall-bladder distended with pellucid fluid and containing 50 small, round, polished stones.	Incision through abd. wall, and then opening sac. Wound in gall-bladder closed by a stitch and not attached to abdom. wall.	Recovery. Out in 4 weeks; in 10 mos. no return of tumor, but pain noted sometimes.		Gall-bladder adherent to omentum.
In favor of distended gall-bladder.	"Much enlarged and walls thickened; 24 oz. fluid and 66 stones removed at operation. 16 stones after death; sacculated ducts all dilated, common open."	Cholecystotomy. After cutting off part of gall-bladder sewed it to abd. walls forming a fistula. Hemorrhagic tendency extreme.	Death on 9th day.	Exhaustion and hemorrhage.	First case of intentional cholecystotomy.
At first ovarian cysts or floating kidney. After aspiration "empyema of gall bladder."	Gall-bladder dilated size of man's head, wall 1 ctm. thick. Contained pus and 32 stones. Supposed that cystic duct was closed.	Cholecystotomy. Formation of fistula, was dilated, more stones removed, and closed. No bile at any time.	Recovery in 5 weeks.	.....	First successful case.

TABLE II.—

No.	Date.	Reporter.	Source.	Sex	Age	Remote cause.	Condition at time of operation. General and special.	Duration. Present disease.
8	Nov. 4, 1878	Keen,	Am. Journ. Med. Sci., Jan. and April, 1879.	F.	60	Mechanical occlusion of common duct.	Tumor 5½ in. in diam., filling its half of belly. Jaundice. Emaciated, anorexia, vomiting, constipation, itching, xanthopsia.	Dull pain 7 months; Jaundice 4½ mos.; tumor 2 weeks
9	Aug. 23, 1879	Tait,	Lancet, 1879, ii. 730, and Med. Chir. Trans., xliii. p. 17, 1880.	F.	40	Gall-stones. History 1 year.	Heart-shaped, movable, firm, elastic tumor, without fluctuation; tender. Emaciated, feeble; anorexia, headache, cachectic appearance.	Pain in right side 1 year; tumor 11 mos.
10	May 3, 1883	Ransohoff,	Med. Rec., N. Y., 1882; xxii. 258.	M.	76	Gall-stone. No history of it, except vague pain 4 years before.	Tumor of gall-bladder, size of fist, movable. Patient weak, dejected, has no appetite, lost 50 lbs. Jaundice 6 months.	Jaundice 6 months.
11	?	Tait,	Brit. Med. Journ., May, 3, 1884.	..	..	.....	.....	.....
12	June 15, 1882	Tait,	Brit. Med. Journ., Nov. 18, 1882, p. 990.	F.	28	Gall-stones. History since puberty.	Tumor in right hypochon. for more than 2 yrs. No jaundice. "Patient very much reduced."	2 years.
13	July 15, 1882	Langenbuch,	Berlin. klin. Woch., 1882, xix. 725.	M.	43	Gall-stones.	Subject to biliary colic for 6 yrs. with icterus and sometimes a tumor; for last 9 mos. attacks every day. Lost ⅓ of body weight: depressed; failing rapidly. Jaundice.	6 years.
14	1882	Winiwarter,	Prag. med. Woch., No. 21, 1882.	M.	34	Closure of cystic duct caused by what was supposed to be peri-typhlitis.	Tumor occupying right half of abd. cavity. Patient slightly jaundiced, fair appetite, lost flesh.	.....
15	Oct. 13, 1882	Tait,	Brit. Med. Journ., Feb. 17, 1883.	F.	37	Gall-stones. Intermittent attacks of colic. (No note as to duration.)	Tumor in position of gall-bladder.	"Some weeks."
16	Apr. 20, 1883	S. W. Gross,	Med. News, Phila., June 9, 1883.	F.	59	Gall-stones.	Nothing abnormal detected until at an operation for nephrectomy on account of sarcoma.	.....
17	June 19, 1883	Musser and Keen,	Amer. Journ. Med. Sci., Oct. 1884, p. 333, and Trans. Coll. Phys., Phila., 1884.	M.	31	Gastro-duodenal catarrh for 8 months.	Tumor in region of gall-bladder. Patient weak, emaciated, icterus intense, tympanitic abdomen.	8 months? tumor 5 weeks.
18	Oct. 31, 1883	Gardner and colleagues,	Anstr. Med. Journ., 1884, N. S., vi.	F.	38	Gall-stones during 3½ mos.	Pain, tenderness, tumor right iliac, first third lumbar and hypogastric region, emaciation, anæmia, dragging pain in tumor, fluctuation; on aspiration, pus. No jaundice: saffron urine and pipe-clay stools.	3½ mos.(?)

Continued.

Diagnosis.	Condition shown by operation, etc.	Operative procedure.	Result.	Cause of death.	Remarks.
Obstruction of gall-duct, based on aspiration.	Gall-bladder moderately thickened, and contained remnants of bile and blood. Cystic duct not distended. Hepatic disintegration.	Cholecystotomy, formation of fistula. Hemorrhage and shock.	Death in 36 hours.	"Hemorrhage and exhaustion" and shock.	
"No diagnosis attempted, and opening agreed upon."	Gall-bladder distended with white, starchy-looking fluid, and containing 2 large stones, one loose, and the other impacted in entrance of duct.	Cholecystotomy. Formation of fistula. Wound healed Sept. 9, 1879. Patient went home well in 5 wks.	Recovery.		
Gall-stone impaction, based on exploring with aspiration needle.	Gall-bladder distended with 8 oz. of a light green fluid, containing 4 stones, one impacted. No post-mortem.	Cholecystotomy. Formation of fistula; emptying gall-bladder of fluid and stones	Death in 26 hrs. though he reacted well after the operation.	Failure of heart's action	Gall-stone sought and distinctly felt by trocar at aspiration.
.....	.....	Cholecystotomy.	Recovery.		
"Gall-bladder distended on account of impacted calculi."	Gall-bladder contained a pint of glairy mucus, and 80 stones, largest weighing 15 grs.	Cholecystotomy. Formation of fistula, which was established perfectly in 30 dys	Recovery, Aug. 5 clear bile flowed from fistula		
"Cholelithiasis."	Gall-bladder not inflamed, but somewhat thickened; moderately distended; 2 small calculi.	Cholecystotomy. Cystic duct tied with silk, and bladder dissected away. Some hemorrhage.	Recovery. Up in 12 days.		
"Dilatation of gall-bladder by obstruction of bile duct" after evacuating 2 litres of bilious fluid.	Gall-bladder dilated, but condition of common duct not made out.	After tapping several times opened abdomen, punctured gall-bladder, fixed it to colon, and that to abd. wall. Five mos. later fastened a loop of small intestine around gall-bladder, and opened with bistoury.	Recovery, though an accidental opening of large intestine resulted in an artificial anus. Fistula healed.	.....	Anterior surface of gall-bladder adherent to peritoneum and transverse meso-colon.
"Distended gall-bladder"	Gall-bladder contained 16 stones varying from 7 to 35 grs. in weight.	Cholecystotomy.	Recovery; wound healed by 11th day.		
None. See present condition.	Gall-bladder distended and contained 1 stone.	Partial cholecystotomy.	Death.	Peritonitis and suppression of urine.	
Distension due to impacted calculus or inflammatory swelling of lining membrane of ducts, based on exploratory puncture two days before operation.	Gall-bladder containing 12 oz. muco-pus. Occlusion of common duct at duodenal opening.	Cholecystotomy. Formation of fistula. Reacted well from operation.	Death.	Exhaustion, inanition, and hemorrhage.	Autopsy:—Gastro-duodenal catarrh Closure of mouth of duct. choled. Dilatation & inflammation of all ducts & gall-bladder. Retention cysts. Liver disintegrated.
?	Gall-bladder contained pus and 114 grs. weight of biliary calculi. Probable closure of cystic duct. Not probed.	Cholecystotomy. Wound healed in 12 days; some small sinuses which discharged glairy, light green exudation.	Recovery.		

TABLE II.—

No.	Date.	Reporter.	Source.	Sex	Age	Remote cause.	Condition at time of operation. General and special.	Duration. Present disease.
19	Oct. 31, 1882	Eddowes,	Brit. Med. Journ. May 1, 1884.	F.	53	?	Tumor upper half abdomen, dull in front, clear resonance on side during 7 yrs.; last ½ yr. grew rapidly.	7 years.
20	1883	Savage,	Brit Med. Journ., Mar. 8, 1884.	M.	ad.	Gall-stones.	Tumor when aspirated discharged first ⅔ colorless viscid fluid, last ⅓ bile.	.....
21 to 29	1882 and later.	Tait,	Brit. Med. Journ., May 3, and July 12, 1884.	..	..	.....	.....	.....
30	?	Tait,	Brit. Med. Journ., May 3, 1884.	..	..	.....	.....	.....
31 to 35	?	Tait,	Brit. Med. Journ., May 3, 1884.	..	..	.....	....	.....

NOTE.—Case 11 has not been reported in detail by Mr. Tait, but is included in his general statement as to his 13 cases, all successful. Cases 21 to 35 are derived from the same source. In a private letter, he states that Case 30 he personally knew of, but it had not yet been reported by the operator, and that Cases 31 to 35 "are scattered through various publications of series of abdominal section."

MEDICAL COMMENTS BY DR. MUSSER.—The most striking feature of the above tables is the wonderfully successful results of operative interference. As is shown, but ten deaths occurred in thirty-five cases. The fatal case of Gross should, however, be excluded from the calculation, as it was merely an incident in a more serious operation.

When the conditions of the nine remaining cases of fatal issue are studied, this termination is not to be wondered at. Most of those of which we have exact details were exhausted by long suffering, and all of them presented evidence of grave organic disease or toxæmia at the time of operation. A study of the cause of death in these instances is important. Excluding the case of Gross, and the three in which the gall-bladder was extirpated, of which we have no details, exhaustion was one of the causes in every

Continued.

Diagnosis.	Condition shown by operation, etc.	Operative procedure.	Result.	Cause of death.	Remarks.
Cyst attached to liver above free at lower border, and containing fluid.	Contents not noted. Bile in discharge on 4th day.	Opened abdom. wall, tapped gall-bladder, and then enlarged the opening into it.	Recovery.		
Hydatid.	Tumor size of cocoa-nut; 14 gall-stones removed.	Cholecystotomy.	Recovery.		
.....	.....	Cholecystotomy. In one case a second operation at which a stone left in duct was crushed by padded forceps without opening the duct	Recovery.	.....	Cases all grouped in a general "note on cholecystotomy."
.....	....	Cholecystotomy. Gall-bladder closed by continuous suture and not attached to abdominal walls.	Death.	Probably escape of bile into abdominal cavity.	Operator unknown.
.....	.....	Cholecystotomy. Gall-bladder extirpated.	3 deaths. 2 recoveries.	?	Operators unknown.

NOTE.—The formation of this table was rendered less difficult by the use of an elaborate one by Dr. George Dock, Resident Physician elect of St. Mary's Hospital, who was engaged in an investigation on the operative measures for the relief of biliary calculi. The writers desire to express their acknowledgments.

instance. Hemorrhage was noted in three instances, cholæmia in one. In no instance was either of these causes due to operative interference, but they were the necessary sequence of the original disorder, and were conditions preventable by earlier interference. Nothing need be said of exhaustion: of hemorrhage it is distinctly shown in the reports of the cases that it was due to the lowered vitality of the blood, caused by the biliary salts.

The autopsies of the few cases on which they were known to be held showed that the liver tissue had undergone such degenerative changes as were incompatible with life—conditions undoubtedly present before the operation. The lesson, therefore, to be learned from the causes of death and the structural changes of the liver, is not to abstain from operating, but to operate in the early progress of the case.

Especially is this conclusion forced upon us when we consider the favorable results our table indicates, and the remarkably brilliant results of Tait, who has not lost one case of the thirteen he operated on.

These conclusions become convictions when the great risks and absolute dangers of biliary obstruction are remembered—dangers arising from exhaustion and toxæmia, risks of rupture, of suppuration, and of ulceration of the biliary passages, and, if caused by a gall-stone, of its passage into various parts of the body. It may be said and truly, that there are many cases, for instance, of gall-stones that terminate favorably even though the patient be seriously ill. But this may be said also, that it is impossible to tell which case will have such fortunate ending, and therefore why wait and take such grave chances?

If it be determined that there are cases of obstruction to the flow of bile which can be relieved by operative measures, and if such an operation be considered justifiable, it is important to indicate the proper cases and the mode of recognizing them. The following pages are intended to be a contribution to these questions.

There are four pronounced conditions which are dangerous sequences of biliary obstruction, and which may be looked upon as operative indications. They are *jaundice*, a *tumor* in the right hypochondrium, presumably an enlarged gall-bladder, *frequently recurring paroxysmal pain*, and symptoms of *suppuration*. Practically these are the symptoms or sequences of biliary calculus, and therefore it may be said that, to consider that affection and lay down rules for its recognition would suffice, especially as in most of the

tabulated cases gall-stones were the primary cause. But then they are also symptoms of other forms of obstruction, some of which are removable by operative measures. It seems, therefore, proper to study the conditions separately, considering gall-stones in connection with each one of the above conditions.

One of the most distinctive evidences of obstruction is jaundice; and at once the nature of it must be determined. Is it jaundice by suppression so-called or jaundice by obstruction? But two of the writers quoted in the table considered this question—Sims and Keen. Both of them laid great stress upon the value of itching, which occurred in their cases, as a symptom of the obstructive variety. The former considered it a pathognomonic symptom of this form and not due to the jaundice, but being a reflex nervous symptom due to the over-distension of the gall-bladder. We think this is making too strong and absolute a case, for itching often occurs in jaundice without over-distension of the bile reservoir, while it may be absent when this reservoir is enormously distended without jaundice. Again, why should not the same symptom occur when other hollow organs or cysts are over-distended? Some important facts concerning jaundice may be gained by further study of our table.

This symptom was stated to be present in but seven cases. The average age of these patients was a fraction over forty-six years; five were males, two females; the duration of the jaundice (when given) was over four and one-half months; enlarged gall-bladder was present six times; a distinct history of gall-stones in four cases; of cancer of the pancreas, of occlusion

by lymph externally, and of catarrhal jaundice, in one each; while cholæmia was noted in only one. The variety of jaundice by suppression most likely to have been confounded with any of the above cases is that due to acute yellow atrophy of the liver. But the persons liable to this disease are generally under thirty and females, while pregnancy, nervous influences, low fevers, phosphorus poisoning, etc., are the exciting causes—conditions and circumstances not revealed by the above analysis. In not one of the seven cases were any of the other causes of this form of jaundice present, viz: Mental emotion, cerebral injury, the poisons of the various fevers, pyæmia, snake-bite, and the mineral poisons. Comparing further, we find enlargement of the gall-bladder in seven cases, a condition impossible in jaundice by suppression.[1]

To recapitulate, we may say that the varieties of jaundice may be differentiated, in a measure, by a consideration of the age and sex of the patient, the cause and the duration of the disease, the intensity of the jaundice, and the presence or absence of itching; more definitely, however, by the occurrence of leucin and tyrosin in the urine and the diminution of the urea; still more positively by the study in addition

[1] It is well known that in the later stages of cirrhosis, jaundice, the pathology of which is probably the same as in acute yellow atrophy, often occurs. It is slight, gradual in onset, without pain, but with ascites. (Murchison.) The writer had a case of cirrhosis and obstruction of the bile-duct, from adhesive inflammation, which presented symptoms during life of the organic change—ascites, enlarged veins, etc., with an *intense* jaundice and paroxysmal pain. The latter symptoms, differing from those which Murchison notes and being the most marked, might have led to operative interference. This combination must be remembered and ascites noted as the evidence of grave organic change.

of the anatomical changes in the liver, the biliary passages, and the surrounding organs. If the liver be atrophied, jaundice by suppression is probable; if enlarged, by obstruction. If the gall-bladder be enlarged, obstruction. If anatomical changes in the stomach, duodenum, pancreas, lymphatic glands, bloodvessels, etc., be present, the jaundice is in all probability obstructive.

Obstructive Jaundice.—There are some organic diseases of the liver which give rise to jaundice, the mechanism of which is no doubt obstructive, which should be distinguished from other forms of obstructive jaundice, for, save in one instance, operative measures are not to be considered in those cases. Reference is made to cirrhosis, atrophic and hypertrophic, to carcinoma, to abscesses, simple and multiple, to hydatid disease, simple and multiform, and to amyloid disease. When discussing the second indication for operative measures, tumor, simple abscess, and hydatid disease will be considered. Amyloid disease and carcinoma will be referred to later; cirrhosis and multiple abscess remain. The atrophic variety of cirrhosis is easy to recognize by its well-known symptoms, save in the exception noted in a previous foot-note. Not so the so-called hypertrophic. The jaundice is intense, the liver enlarged and smooth, ascites is absent, paroxysmal pains occur and irregular fever is present.[1] In other forms of obstruction the liver is not so large, the gall-bladder *is* enlarged, while a distinct cause for the jaundice, as a tumor, may be discovered. Regarding multiple abscess Dr.

[1] See Path. Soc. Trans. Phila., 1877–78. Am. Journ. Med. Sci., July, 1884.

Carrington[1] analyzes a series of cases and shows that the following group of symptoms portray the disease. The patient is extremely ill, and the "illness appears to be abdominal," with evidences of local or general peritonitis; he is emaciated; his abdomen is distended and the seat of pain; the liver is enlarged, painful, and tender; vomiting is frequent; diarrhœa or constipation occurs in an equal proportion of cases; jaundice in one-third of all cases; the temperature is irregularly febrile; rigors occasionally; the pulse and respiration are hurried. The cause of these abscesses is either the occurrence of an ulceration at some point in the area of the portal circulation or prolonged obstruction to the flow of bile, the condition that arose in the second of our cases. In no case was there a tumor of any kind. There is no one sign or symptom pathognomonic of this disease, and it can be inferred only by the previous history of the patient with the grouping of the detailed symptoms. The presence of such symptoms, even though indications of biliary obstruction be present, would make an operation for the relief of the latter hazardous, almost unjustifiable.

The diagnosis of obstructive jaundice having been determined and the presence of irremediable hepatic disease eliminated, it is next important to define the nature of the obstruction, for only some varieties would admit of interference. Recurring to the tabulation,[2] we find of seventeen cases, gall-stones caused the obstruction in thirteen of them; cancer of the

[1] Guy's Hospital Reports, 1882.

[2] Any numerical estimate is necessarily only tentative, since details of many of the cases (especially Mr. Tait's) are wanting.

pancreas, peri-hepatitis, and gastro-duodenal catarrh in one each; and one was doubtful. This proportion is probably the proper one. It is not within the province of this paper to discuss in full all the forms of obstructive jaundice, and their differential diagnosis. The following remarks are suggestive of cause and conditions that may arise and of a few methods of diagnosis.

The causes in general of stenosis of the bile-ducts are three:—

1. Foreign bodies within the ducts (gall-stones, parasites, etc.).
2. Diseases of the walls of the ducts (*a.* Congenital; *b.* Adhesive inflammation or cicatrization of ulcers; *c.* Peri-hepatitis).
3. Tumors, etc., external to the ducts.

1. *Foreign Bodies.*—If due to *worms* they may be recognized by the age of the patient, and the presence of the parasite in the ejecta. Their presence is indicated by an attack of hepatic colic; an absolute diagnosis cannot, and practically it need not, be made. Not so *hydatid cysts* bursting into the bile-ducts, with symptoms of hepatic colic. The diagnosis can be more readily made in this instance: first, by the previous history and physical signs of an hydatid tumor; second, by the disappearance of the tumor after the colic; third, by the subsequent occurrence of fever and local inflammation; lastly, the appearance of sacs or hooklets in the vomited or aspirated matter.

Gall-stones.—It is of the utmost importance to determine the presence of biliary calculi; for of twenty-one tabulated cases they were present in six-

teen, causing obstruction or otherwise endangering life. In most of the others, also, they were undoubtedly present. The differentiation of them is sometimes very difficult, and in fact often impossible. The varying symptoms of cholelithiasis are so many that it is not possible to name one of them, or to present a group of them, for the purpose of making a diagnosis, without being able to give an exception to each and every one. The only absolutely definite sign is to see or feel the calculus. If one has been passed by the rectum, it probably was the cause of obstruction; if it have facets on, a fellow may be the cause.[1] If not detected in the stool, exploration of the gall-bladder must be resorted to, either by opening the abdominal cavity, or, as successfully practised by Whitaker, the insertion of long needles into the viscus.[2] Martin-Solon (*Jour. des Conn. Med.-Chir.*, Paris, 1849, xxxiii.) reports a case in which the stones could be on palpation detected, if the patient took a forcible inspiration, the hand being on the gall-bladder. He considered it a new mode of diagnosis.

Aside from these positive methods, a correct conclusion cannot be arrived at without a study of the case in its entirety; the age and sex of the patient, the habits, the family history, the temperament, all are important to examine into. If these circumstances are favorable, and, in addition, the patient has had previous attacks of hepatic colic, *followed* by jaundice and the symptoms of duodenal catarrh; if constipation and putty-colored stools accompany the jaundice, the diagnosis is very probable. Then if, after impac-

[1] In cases of cancer of the gall-bladder and ducts, calculi are often passed.

[2] N. Y. Med. Record, 1882, i. 568.

tion has taken place, the nutrition of the patient remains good for a long time, the liver enlarges only slightly, while the gall-bladder increases in size, it is scarcely possible to name any other affection. Campbell (*Brooklyn Annals*) suggests that if, after aspiration of the gall-bladder, bilious stools are present, calculi are the cause of obstruction. The relief of the tension allows the stone to recede, and the bile to escape. Gall-stones, threatening life, without jaundice, will be treated of later.

2. *Diseases of the Ducts.*—1. Congenital closure. Jaundice in an infant, continuing over four weeks, with cholæmia supervening, is due most frequently to this circumstance. 2. Closure of the ducts by chronic catarrh of the duodenum, adhesive inflammation of the ducts, the healing of an ulcer in the duct or at the duodenal orifice, and by fibrous bands. The first may be recognized by exclusion, and the history of the cause of, and the attack of, catarrhal jaundice. The second case reported in this paper belongs to this category, and the reasons for the diagnosis in that case (see remarks under Case II.) appear to be ample for the diagnosis of any stenosis from a similar cause. Adhesive inflammation of the ducts is due either to the passage of biliary calculi or to a previous catarrh. The respective symptoms of the two must be considered in such case.

Ulcers in the bile-ducts are due to gall-stones or are secondary to the low fevers. In the former case, in addition to the symptoms of gall-stones, we have, accompanying the ulceration, irregular chills and fever and extreme exhaustion, conditions not likely to be present in the early stages, at least, of simple impac-

tion. If these symptoms of obstruction develop after such phenomena or after a low fever, the exciting cause is probably the healing of an ulcer in the ducts. The well-known symptoms of duodenal ulceration precede for a long time the symptoms of obstruction of the biliary passages due to the healing of the ulcer; while it may be said that the gall-bladder is enlarged under such circumstances, it is not necessarily so when the seat of ulceration is in the duct. Closure of the ducts by fibrous bands may be inferred, if the cause (as syphilis) and the symptoms indicate a peri-hepatitis, and if other evidence of old lymph be present, as atrophy of the liver or ascites, etc., due to pressure on the portal veins.

3. *Diseases external to the Ducts.*—1. Carcinoma and other neoplasms of the liver and surrounding organs. A diagnosis of this affection can be made by the exclusion of other causes of obstruction, by the presence of carcinoma elsewhere, if tumors or nodules and the physical signs on palpation, etc., be present, if the tumor preceded jaundice, if cachexia be present, if there be alterations of the functions of adjacent organs, and the presence of the symptoms of malignant disease of these organs, and finally by the duration of the disease, the stenosis from carcinomata being of shorter course than from other varieties. 2. Enlarged lymphatic glands. Obstruction from this cause is probable if there be elsewhere present any of the well-known causes of hypertrophy of these glands, as carcinoma, tuberculosis, amyloid disease, etc. Amyloid disease but rarely causes jaundice by any other way; its symptoms are too well known to be detailed in this paper. 3. Aneurism. This rare

form of obstruction may be recognized by the pressure-symptoms of a tumor located in the region of the duodenum and by the physical signs of aneurism.[1]

The *second* indication for the performance of cholecystotomy is the presence of a *tumor*, presumably an enlarged gall-bladder, which is seriously imperilling the life of the patient. It is not so much that the tumor is serious as that the cause of it is serious; it is a sign of a harmful lesion. This enlargement is due to obstruction to the outflow of bile, to the retention of gall-stones, to inflammation of the walls of the bladder, to malignant disease of the walls. It was observed in eleven of the tabulated cases. The following account of the characters of such a tumor is based on the study of these cases and the conclusions of various authors.

Position and Size.—They varied very much in the thirteen cases in which they were recorded. Regarding position, it was said to be in the position of the gall-bladder (15),[2] in gall-bladder region (17), in right hypochondrium (12), to be a tumor of the gall-bladder (10), and to be in anterior upper half of abdomen (19).

The location differs with the age of its development; thus, early in one case, it was on the right side (5), or the position named; in another in the right iliac region (14). Late in the disease the position was more definitely defined, extending in one from the liver five and a half inches to the right iliac fossa, just inside the right ilium (5); from median line to the right flank, and from the liver to the groin in another (1); again, from lower border of liver to four inches below

[1] Frerichs, Dis. of the Liver. Von Schüppel in Ziemssen's Encyclopædia, vol. ix.

[2] The bracketed numbers refer to the number of the cases in the table.

it, the lateral border bounded by two lines, the upper from nipple line to spine of pubes, the lower from the same point to one-half inch to right of umbilicus (4); at lower border of liver in right hypochondrium continuous with the liver, extending below umbilicus 11 cm., and from linea alba to false ribs (6); median line to right flank, liver to groin (14). In the size there was considerable variation. It ranged from that of a hickory-nut (5) to that of a man's fist (10) or head (7); one was five and a half inches in diameter, and filled its half of the belly (8); one contained thirty-two ounces of fluid (6); another yielded six ounces, and did not change in size. In the main these facts agree with the teachings of authors on this subject, though some narrate more remarkable cases; thus the position and size have been so great as to distend the floating ribs on both sides (Coupland, *Dict. Pract. Med.*, ii. p. 4), or to fill almost the entire abdominal cavity, causing a diagnosis of ascites to be made (Benson. See Frerichs, *op. cit.*). Generally the tumor was evident to the naked eye. An area of resonance was often found between the liver and the tumor. It is important to bear in mind the point from which, and the direction toward which the tumor grew—in the right half of the abdomen toward the umbilicus, or into the right iliac fossa. Prof. Janeway[1] states that the gall-bladder is enlarged if it be situated under the free border of the ribs at a point where it is crossed by a line drawn from the point of the shoulder to the symphysis pubis. Then it is to be remembered that the gall-bladder is not so large when gall-stones or

[1] On the Diagnosis of Hepatic Affections. By Prof. E. G. Janeway, Sims's Am. Clin. Lectures, vol. iii., Nov. 1877.

carcinoma is the cause, nor when purulent rather than biliary fluid is confined in the cavity.

The Shape.—Most authors describe an enlargement of the gall-bladder as a pyriform,[1] or a semi-globular,[2] or globular[3] tumor. In seven of the cases the tumor was described: as globular in two cases (8–10); in one oblong rounded (6); long oval (7); pyriform (2); reniform (12); heart-shaped (9); round (17); rounded irregularly (1).

Character of Tumor.—The following terms have been used to express the character of the tumor on palpation (numbers in parentheses show how often preceding term used): Hard or firm (5); elastic (3); tense (2); smooth (2); fluctuating (2); non-fluctuating (2), and soft (2); as to sensibility, painful (1) or tender (6); as to movement, seven were movable and two noted as rising and falling synchronously with respiratory movement. Collating the terms most frequently used, an enlargement of the gall-bladder may be said to be, in the majority of cases, movable, tender, firm, elastic, and fluctuating; on the other hand, it may have directly opposite qualities. If the gall-bladder be filled with calculi, or be the seat of malignant disease, its semblance would be far different from that presented when distended by fluid. Again, the character may change; hard at first, it may become soft; tense, it may fluctuate later. The detection of fluctuation is of extreme importance. The difficulty of detecting it is due to tension of the cyst, to tympanitis, and to fatty abdominal walls.

A further proof of a tumor in the right hypochon-

[1] Murchison and Von Schüppel. [2] Frerichs. [3] Harley.

drium being an enlarged gall-bladder is in the fact that the intestine is never in front of the growth. Finally, an investigation into the nature of the contents of the tumor, if it be a hollow organ, yields the most definite facts for diagnosis. This knowledge is furnished by tapping, or by the introduction of long needles. The latter procedure has been mentioned before in this paper, and will be at once dismissed. The former is worthy of full discussion.

The contents of the gall-bladder vary much in character, as an analysis of eleven cases will show. The fluid described is generally that taken from the gall-bladder at the autopsy, and may differ from the fluid evacuated by an aspirator before any operative interference, as in Case 17. This fallacy must be noted; remembering it, we find that the contents were a glairy pellucid fluid in three of the cases; pus in two; and bile and blood, a light-green fluid, a thick brown fluid, a fluid and muco-pus in one each. When bile or bile-stained fluids are present, that the source is the gall-bladder is almost positive. But when the fluid is of a serous nature, a chemical analysis must be resorted to as well as in those cases the fluid of which appears to the eye like bile (Sims's case), the examination alone determining its character positively. In fine, in every case the analysis should be made. This was done in Sims's case, the first one of Keen's, and in one of the cases here recorded. The first contained no bile; the second contained a trace of bile acids and cholesterine; the third resembled serum in its reactions.[1] Even if the fluid contain no bile-

[1] In two unpublished cases of the writer a similar fluid was found, the one by tapping, the other at the autopsy.

elements it may still come from a distended gall-bladder whose duct is occluded so that no bile enters it, for after a certain time the bile that was at first present may disappear and be replaced by the mucoid secretion of the gall-bladder itself. Naturally this occurs especially frequent in prolonged cases. How rapidly this secretion may increase is shown by Sims's case, in which the gall-bladder increased 3 cm. each way in eight days, yet no bile was present in the fluid. Under these circumstances we would have to decide whether the fluid was from the peritoneal cavity—a general or localized effusion—or from the gall-bladder. Prof. Richardson tested fluids with fresh blood for Dr. Keen, and found that well-defined red corpuscles are destroyed in a fluid containing more than seven per cent. of bile. A similar test, Keen says, would be of value from a diagnostic point of view. The history of the case, together with the occurrence of fluid in other parts of the peritoneum, if localized, goes to make up the diagnosis. The absence of the well-known chemical and microscopical characters of a hydatid, renal, or ovarian cyst would exclude either of these.

To recapitulate, we may say that if a tumor be found in the right hypochondrium, pyriform or globular in shape, fluctuating, tense, or elastic, tender on pressure, movable, yielding a fluid on tapping containing bile elements, we may conclude positively that it is an enlarged gall-bladder. An enlarged gall-bladder may be found in other regions, as the lumbar, hypogastric, or iliac. The sac of a hernia contained the gall-bladder in one case. The nature

of the tumor in these cases would be determined by the history of the case and the results of tapping.

It may, however, be a tumor of the liver itself, of the stomach, duodenum, pancreas, or the lymphatic glands. When considering jaundice by obstruction, these conditions were discussed, and it is only necessary to say that the combined symptoms and signs then noted with a study of the tumor as above indicated will render a diagnosis possible. There were two conditions of the liver not mentioned, because jaundice rarely occurred in them, that must be distinguished from a tumor of the gall-bladder—abscess, and hydatid disease. If an abscess is suspected, the cause, the general and local symptoms, the absence of jaundice, the induration, and then the softening and fluctuation of the swelling should be present. The painless, slow course of hydatid disease, the broad base of the cyst, the fremitus and the results of tapping serve to render the recognition of this disease possible, if taken with the negative symptoms of enlargement of the gall-bladder. In multilocular hydatid disease, the tumor resembles a gall-bladder enlarged and containing gall-stones; like the latter, it is nodulated, hard and tender, but it is associated with early jaundice, ascites, an enlarged spleen, œdema of the legs, great emaciation and prostration, with rapid decline of the patient, conditions, excepting jaundice, not likely to be present in gall-stones.

In addition to the various conditions which have been mentioned, which are liable to be confounded with an enlarged gall-bladder, the following are yet

to be considered: floating kidney, and renal and ovarian tumors.

Floating Kidney.—One of the cases in the above table was diagnosticated as floating kidney. A similar case was under the writer's care, and there are others scattered through the literature of hepatic disease. If it be remembered that the enlarged gall-bladder is more movable at the lower than the upper portion, that one end is larger and more rounded than the other, that fluctuation may be present, that biliary symptoms are generally present, while the absolute sign of floating kidney, an abnormal area of resonance in the renal region, is absent, the mistake is not likely to be made. Tapping would also be invaluable as an aid.

Renal Tumors.—Sarcoma, hydro-nephrosis and pyo-nephrosis. In these diseases there are changes in the urine to call attention to them. These renal tumors at first always have the intestines in front of them; they are not influenced by respiratory movement or continuous with hepatic dulness; in hydro-nephrosis, a previous renal colic and possibly frequent discharges of urine followed by diminution in size of the tumor occur. These questions of diagnosis arose in the study of the case of Kocher, as did also that of ovarian tumor. He relied much on the results of exploratory puncture, as previously discussed. A connection between the tumor and the uterine appendages, and the seat of origin and direction of development of the growth, are the points in favor of ovarian tumor; in addition to which, if the fluid be characteristic, the diagnosis of such a tumor would be doubtless correct.

Having determined the presence of an enlarged gall-bladder, the next question to decide is the nature of this enlargement. The gall-bladder is enlarged on account of dilatation by bile, pus, serum, mucus, or calculi, or on account of carcinoma of its walls. Practically we need only decide if carcinoma be present. If secondary, this is not generally difficult; if primary, it is extremely so. Primary carcinoma occurs generally in the old and in females; it is generally preceded by attacks of biliary colic and accompanied with jaundice and vomiting, sharp localized pain, and all the symptoms of the cancerous cachexia. The tumor is hard and nodulated, not movable and not fluctuating.

The *third* indication for the performance of cholecystotomy is the occurrence of *severe pain* in the region of the gall-bladder, due presumably to a gall-stone. In order to prevent these attacks in persons disposed to the formation of biliary calculi, extirpation of the gall-bladder has been proposed and successfully performed.

Hepatic colic without jaundice occurs when the stone is confined in the bile reservoir or cystic duct. The recognition of gall-stones has been previously discussed. Pain, being the very distinctive symptom of this class of cases, must be distinguished from the pain of pleurodynia, intercostal neuralgia, gastralgia, renal and intestinal colic. The points of distinction are sufficiently obvious not to need detailing. A decided answer would be to find the stone by the long needles previously referred to. If the exit to the gall-bladder be entirely closed, a tumor will certainly form, the mode of recognition of which we have pre-

viously discussed. It is to be remembered that the aspiration of such a cyst would yield not bile, but a clear or colored fluid, the product of secretion from the walls of the gall-bladder.

Finally, cholecystotomy is clearly indicated in cases the symptoms of which are due to internal suppuration. Hectic endangering life may be from simple or multiple abscess of the liver, abscess of the gall-bladder, suppurative inflammation of the ducts and of the portal vein. The latter condition especially must be differentiated. Having the symptoms of jaundice, pain, enlargement of the liver, hectic and emaciation in common with the other inflammatory affections, we have to rely on the enlarged spleen and the discovery of the foci of inflammation to distinguish it. The tumor in the gall-bladder affections, and in abscess of the liver, is wanting in pylephlebitis. Excluding it, and also simple and multiple abscess of the liver by means indicated earlier in the paper, we have left the similar affection of the gall-bladder. The characters of the tumor have been dwelt upon; the surgical means, aspiration, spoken of, both of which, taken with the history of the case, aid one materially in the diagnosis. Withal it may be said, if pylephlebitis can be excluded, laparotomy at least should be performed in cases of suppuration dangerous to life. It is true there are cases of suppurative inflammation of the hepatic ducts that get well; rare are the cases, if any, of multiple abscess. Now, if the gall-bladder be opened and vent given to the discharges, it certainly gives the patient a very good chance of recovery. After a study of hepatic affections in their entirety, with the brilliant results

of surgical treatment shown by the tables, the conviction is forced upon one that the duty of the medical man is to observe with extreme minuteness the course of the affection, so as to be able to make a clear diagnosis, and above all not to postpone any attempts at surgical relief until pathological changes have taken place in the liver which are beyond repair. Many cases undoubtedly are lost by this fatal delay, our own among the number.

Surgical Remarks by Dr. Keen. *Diagnosis.*—The diagnosis from the medical point of view is fully discussed by Dr. Musser. The diagnosis by surgical means is made by 1, aspiration with or without exploration by a probe; and 2, by acupuncture.

1. Simple aspiration is not a wholly harmless method, as was proved by the first case I operated upon, in which considerable local peritonitis was lighted up (No. 8), and not a little hemorrhage was caused even by a hypodermic needle. But it is one of the slighter risks incident to the disease, and ought in our opinion always to precede any more serious operation, such as opening the abdomen. The light it throws upon the physical facts is too valuable to be neglected.

Combined with aspiration we may use a probe passed through the canula. Petit as early as 1733 (*Maladies-Chir.*, i. 282) proposed paracentesis and exploration by a sound, but his proposal was apparently forgotten till Bartholow, in 1876, actually used this method successfully. Brown (*Brit. Med. Jour.*, 1878, ii. 916) also apparently put it in practice. It should certainly be tried when an aspiration is done, but that it will not always give information to be

relied on implicitly is shown by Campbell (*Brooklyn Annals*, i. 87). No stone was found by the probe, yet the *post-mortem* showed that one existed in the common duct. Stones in the gall-bladder, however, could ordinarily be so discovered.

2. Acupuncture was first proposed by Whittaker of Cincinnati, and practised by him and Ransohoff (*N. Y. Med. Record*, 1882, i. 568), and more recently by Harley (*Med. Times* (London), May 17, 1884). Harley terms it "an easy and safe method of sounding for impacted gall-stones," and fails even to make mention of Whittaker and Ransohoff's much earlier proposal. That it is fairly "easy" both cases show, but that it is not "safe," except when very carefully and guardedly done, Harley's own case shows. After a short convalescence, due, it was believed, to dislodgment of the stone, and its escape into the duodenum (an assertion not proved, however, by finding the stone either during life or at the post-mortem), a fatal enteritis and peritonitis supervened. In both cases the Dieulafoy needle (or long French exploring trocar) was used. Whittaker and Ransohoff state that the gall-bladder was fixed by pressure from below, and the aspirator needle was introduced "just below the gall-bladder." At $4\frac{3}{4}''$ they detected the stone on two occasions, though it had to be searched for more than once the second time. Harley introduced it first fruitlessly "midway between the umbilicus and the liver margin $1\frac{1}{2}''$ to the right of the median line." On-re-inserting it $1''$ higher up and $2''$ from the median line the stone was struck at a depth of $6''$. On withdrawing the stylet its size and shape were estimated with the end of the canula to be those

of a hazelnut. From the point of puncture the instrument in both cases was pushed upwards and backwards "in the direction of the common duct," as nearly as could be judged—a rather vague statement.

We are not averse to exploratory punctures. They are, as Mr. Barwell said, in discussing Harley's case, "a valuable preliminary," and may throw much light on the diagnosis. But such groping around in the dark among important and vital organs should be done with great care. Rather than to search out of the direct line of puncture by vertical or lateral deflections of the point which might do much mischief, we would prefer either almost to withdraw the needle and to advance it again in a new direct line two or three times or to make wholly new punctures, as in Harley's case. Once that the stone is struck Harley's method of investigation by the canula alone seems proper and useful. It would be even more useful in searching for stones in the gall-bladder than in the duct.

Operation.—If the diagnosis be then reasonably well established, or if it be obscure and yet the symptoms so serious as to require surgical interference, an operation should be done. In a certain sense, every operation is one of exploration. With former views such an operation as laparotomy would only be undertaken *in extremis*, but with our modern views and methods much earlier and therefore much more frequently successful operations may be done. Exploratory opening of the abdominal cavity, under antiseptic precautions, strange as the doctrine may sound to those of us old enough to have been accustomed to hear the peritoneum named with dread, is one of the safest operations in surgery. But little if any reaction follows it, and if the facts learned are such as to pro-

hibit any further action, the abdomen is simply closed and the patient almost invariably recovers, the wound healing by first intention within a week. Mr. Tait even states that he has never lost a patient from such an operation. We would do well to cultivate more of his boldness. In reading the many cases that have perished from gall-stones perfectly accessible and perfectly removable, I have been struck with the many lives sacrificed to timidity and n glect of action. To wait, as was ormerly done, for adhesions to form and the "abscess" to point is in most cases simply to wait for death. We would therefore strongly advocate exploratory operations, followed, if the ascertained facts warrant it, by cholecystotomy properly so called.

Before considering this operation in detail, reference should be made to Kocher's case of cure of an almost certain case of empyema of the gall-bladder by three injections of a five per cent. solution of carbolic acid. The quantity used was a hypodermic syringeful. But this is the only case I believe so far recorded, and we know too little of its details to assert anything as to the method save that it is worth further trial.

Cholecystotomy.—Mr. Hulke (*Brit. Med. Jour.*, 1879, i. 819) says that the operation is treated exhaustively in the "Mem. de Chir." about 1706. I can find no such memoirs in the complete list prefaced to the index catalogue of the Surgeon-General's Library (vol. i. to v.), and the *Mém. de l'Acad. Roy. de Chir.* do not begin until 1743. All of the earlier references to an operation for gall-stones (such as Bloch, Morgagni, and others referred to by Good (*Study of Med.*, 1825, 2d ed., i. 420), and other

writers) are to operations ether by opening supposed abscesses or similar tumors and removing stones from them, or by dilating old fistulæ the results of spontaneous rupture. Such was Mr. Bryant's recent case, often erroneously referred to as a "cholecystotomy." Last April Dr. Marie B. Werner called me in consultation in a similar and successful case in Camden, N. J.

There are several different methods that have been adopted to reach the gall-bladder. They may be grouped in four categories:—

First, those in which the gall-bladder has been opened after adhesions have formed to the belly wall in the progress of the disease. Some of these cases have been incised as if simple abscesses. In other cases the cyst has opened externally spontaneously, resulting in biliary fistulæ, through which later operations have been done. All of the older operations, as far as known, belong to this first class, which we dismiss at once, as not within the purview of this paper.

Secondly, operations to reach the gall-bladder performed, after provoking adhesions by causties, such as potassa fusa, etc. Causties, however, often fail to produce such adhesions (as in Campbell's case), and the patient is needlessly tormented and pained by what are practically two operations; and much valuable time is apt to be lost.

Indeed, it may be said that on this point of previous adhesions, produced pathologically, or by causties, the whole progress of modern surgery in contrast with the older, more painful, and more uncertain operations hinges. It is precisely in this respect

that modern surgery has the advantage, not only as to the surgery of the liver, but of all other abdominal operations. He who waits for nature or caustics to make adhesions ere he ventures to open the belly, is practically prohibited from exploratory abdominal section, with all the knowledge, and certainty, and success attending it. Boldness, in view of the safety of modern methods, is true conservatism.

Thirdly, operations done *en deux temps*, in which the first step is an exploratory laparotomy with a view to subsequent opening of the gall-bladder when adhesions have followed. These adhesions are produced by awaiting the results of inflammation, the bladder being left *in situ*, and the wound either let alone or kept patulous by dressings; or the unopened gall-bladder may be stitched to the abdominal wound. The former method should rarely if ever be employed. It is too uncertain, for in the constant movements of the abdominal contents, other organs than the gall-bladder may adhere to the wound, and our object be defeated; and, moreover, it has the serious objection of leaving the abdomen open, with the possible risk of displaced dressings, and herniæ from vomiting, coughing, etc.

The latter method is not without its advantages. The exploratory laparotomy has given us all the knowledge of existing pathological facts, except exploration of the interior of the gall-bladder itself, and adhesions will certainly form and prevent the escape either of bile or of the mucous secretion of the gall-bladder into the peritoneal cavities, the only object to be attained by such a modification of the operation. But practically the scoop before referred to prevents any such escape during the operation, and

the accurate attachment of the sides of the opening in the bladder to the abdominal wall by sutures, and the later adhesions, which speedily occur, obviate all such dangers. That the bile, or even the mucus secreted by the bladder, especially if it contains a ferment, as Mr. Tait thinks, would be a very possible cause of peritonitis is most likely, but the singular immunity of the patients from such peritonitis is a sufficient practical answer to the theoretical objection.

Fourthly. Cholecystotomy properly so called. The first one to propose this operation was undoubtedly Thudichum, in a paper on the "Pathology and Treatment of Gall-stones" (*Brit. Med. Journ.*, 1859, ii. 935). "In decided cases," he says, "the surgeon should consider the propriety of planning and performing an operation for the extraction of these foreign bodies, *either in a direct manner*, or by forming a biliary fistula and adopting a lithotriptic proceeding. The operation is much slighter than lithotomy. Compared to such operations on the abdominal organs as extirpation of ovarian tumors, it sinks into insignificance." Again, in 1876 (*Brit. Med. Journ.*, 1876, ii. 694), had he found evidence of a stone by palpation (which had been frequently done before but could not be done later), Mr. Maunder was willing, after explaining all the risks to the patient, to open the abdomen, fix the bladder to the abdominal walls, and open it after adhesions. Still later, Dr. Handfield Jones (*Med. Times and Gaz.*, 1878, i. 246) proposed cholecystotomy.

But the actual surgical initiative was taken by two American surgeons. June 15, 1867, Dr. Bobbs (*Trans. Indiana State Med. Soc.*, 1868, p. 68), in an

obscure case of abdominal tumor, opened the abdomen, and then the tumor, which proved to be the gall-bladder, and removed a number of calculi. While not knowingly intending to do cholecystotomy (he calls it "lithotomy of the gall-bladder"), yet such it actually was. But to Sims must be given the credit of first distinctly formulating such an operation and of practically perfecting it both in design and technique. (*Brit. Med. Journ.*, 1878, i. 811.) Slight modifications have been proposed and done, but practically the real work was done when his paper was published. "The entire possibilities of the treatment of gall-stone and distended gall-bladder are exhausted" by Sims's paper (Tait). Let us now consider its steps in detail.

The incision should be made, as a rule, over the centre of the tumor and parallel to the free border of the ribs. The far greater facility of access to the tumor overbalances any less hemorrhage from one in the linea alba. It should be about three inches long, *i. e.*, sufficient for exploration. If need be, it may be enlarged later. All bleeding should be arrested by hæmostatic forceps or catgut ligatures before opening the peritoneum.

This being opened, two fingers should be used, or if necessary the whole hand, to explore the condition of the various abdominal organs and learn the exact nature, attachments, etc., of the tumor, and, as far as possible, the character of its contents. The cystic duct and common duct should be examined with special care, to determine, if possible, the presence and situation of gall-stones, their size, shape, mobility, etc. If any be found in the ducts, the sug-

gestion of Handfield Jones to endeavor to push them into the duodenum should be tried. This failing, we should endeavor to push them back into the gall-bladder—a manipulation much more likely to succeed, for this part of the ducts has already been dilated by their onward passage. Very possibly they may be so fixed as to be immovable (Tait). Whether we can find any stones or not, if the bladder be distended with fluid, it should now be aspirated, the scoop already described being used to carry off any liquid contents, thus preventing its escape into the peritoneal cavity, and at the same time to keep back the intestines, which would otherwise tend to escape.

The gall-bladder should now be incised to the extent of an inch, or more if necessary, the scoop still serving as a conduit for any escaping fluid. By the probe and various ordinary forceps any gall-stones may now be discovered and removed. It is not always easy to find all the stones that are present. In Bobbs's case, and in one of Tait's, a stone known to exist had to be left. In the former it was probably sacculated, but at all events, though felt, it could not be reached. In Tait's it was in the common duct, and could not be removed. [Because of adhesions?] The case recovered, but with a pin-hole fistula. All the bile escapes at the fistula and none into the bowels. Three times he has tried to close it, but each trial was followed by severe bilious colic, until the bile re-escaped in about fifty hours. In this case he proposes to re-open the abdomen and crush the stone *in situ* with padded forceps outside

of the duct.[1] In his first case, Tait was compelled to extract a stone piecemeal, by a careful and difficult operation. In many, if not most of the operations, other stones not discovered at the operation have escaped subsequently. This shows the wisdom of the last step in the operation, viz., the establishment of a biliary fistula by stitching the edges of the opening in the gall-bladder to that in the abdominal wall. A large fenestrated drainage tube should be inserted and the whole covered with antiseptic dressings. For the first few dressings, when the discharge will be large, some carbolized sponges may be also placed under the dressings to absorb this discharge.

The fistula will ordinarily heal within a few weeks at least—in marked contrast to the fistulæ following nature's method of adhesion and external discharge. In these the opening is generally insufficient to permit the escape of the gall-stones, and the fistula with all its dangers may continue open even so long as fourteen years.

The collapsing gall-bladder might be supposed to drag on the abdominal wall by its adhesions, but no such trouble has been reported.

For a considerable time a terwards it might be

[1] Tait (*British Med. Journ.*, July 12, 1884), in this case of stone in the common duct, states that he did crush the stone (size of a cherry) by two strokes of the forceps. "After it was broken the fragments dispersed, and they have given no trouble at all since the operation, only a very small quantity of mucous fluid faintly tinged with bile has come through the fistula, and the patient's motions are normal in color." He intends to close the fistula in a few days. [Should not the fragments have been removed, unless indeed they escaped into the intestine (the word "dispersed" does not seem entirely clear), lest they prove the nuclei for formation of future stones? K.]

necessary in some cases to prevent any possible tendency to a ventral hernia by a compress and bandage.

The experience of operators has varied very much as to hemorrhage. In two of my operations this has been a formidable danger, not so much by the vessels wounded as by the tendency to profuse and uncontrollable oozing even from inadvertent needle-pricks; this seems to be due to the condition of the blood in those cases in which the long-continued jaundice has disorganized that fluid. In Sims's case large intestinal hemorrhages occurred, probably from the same cause; the liver, also, in such cases, is softened, and its integrity almost destroyed. Both of these facts are strong arguments in favor of an early rather than a late operation. Many lives will be saved in the future by such an early resort to abdominal section. Coupled with the slight dangers attending such an exploratory incision the dangers of delay should make us unwilling, by waiting, to jeopardize life in any serious case

The hemorrhagic tendency in such cases should make us careful not to excise any portion of the wall of the gall-bladder. I see no object worth the risk of such a procedure, and where it entails additional danger it should certainly be avoided. Sims did it in his own operation, but considered it, and rightly, an error.

Whether the opening in the gall-bladder should not be closed by sutures, and the bladder be abandoned in the abdominal cavity, is a question worthy of consideration. In Bobbs's case he seems to have so closed it by a single suture, and yet the patient recovered and was well after ten months. In Gross's case the stone was drawn into the fundus of the gall-bladder, and both were cut away after securing the bladder by

a catgut ligature, presumably encircling it; the patient lived only sixty-five hours (nephrectomy had been done for medullary sarcoma), but the biliary pedicle was found "in an excellent condition." Mr. Tait says this procedure (which he ascribes to Sir Spencer Wells) has been adopted once, he knows, and unsuccessfully, a large quantity of bile being found in the peritoneal cavity (Case 30). The case has not yet been reported. He calls attention to the periodical filling and emptying of the gall-bladder, the latter by a much more vigorous muscular action than is generally believed, and he points out the fact that if a gall-stone is left in the duct (which may readily occur), the wound would probably be reopened. Whether the stone be in the cystic duct or the common is of no moment, for, in the latter case, the bladder would be refilled with bile; and, in the former, by its own secretion. We think, as a rule, his point is well taken especially in view of the impossibility, in general, of affirming that all the stones have been removed at the operation. Even if all the stones have been removed, the fistula resulting from an attachment of the gall-bladder and the abdominal wall will close very soon if the duct be pervious. Moreover, the danger of obstruction in the duct by other causes than gall-stones, as in our third case, is to be remembered; to establish a biliary fistula, therefore, seems the better practice by far. If, however, a probe could be passed into the duodenum, and there be a reasonable certainty that all stones have been removed, closure of the gall-bladder, by Gély's sutures or otherwise, might be done with propriety.

Still another question is raised by Langenbuch's

successful case, viz., the propriety of the entire removal of the gall-bladder after ligation of the cystic duct, and evacuation of the gall-bladder (if distended) to prevent the escape of its contents into the peritoneal cavity. Tait states that this has been done six times, with three deaths.

As a general rule, we should be opposed to such a removal; true, some animals have no gall-bladder, sometimes it is congenitally absent in man, and sometimes it has been removed (as by Langenbuch), or has been functionally absent when all its bile has escaped by a biliary fistula. The only object in removing a gall-bladder is to prevent the future formation of stones; and hence, as in Langenbuch's case, it is rather a remedy to be applied to chronic and repeated cholelithiasis than to any ordinary case of acute and unwonted obstruction. Moreover, the danger from an unremoved or undiscovered stone, if it be in the common duct, is too great to justify such a removal, unless it is clear that the duct is patulous. Even severe cases of inflammation of the gall-bladder, the result of calculi, are readily cured by the removal of the calculi, and the establishment of a temporary fistula. It seems as a rule, therefore, needless to add to the already sufficient dangers those which may follow the extirpation of this organ.

One other possibility exists. If we are sure that no calculi remain in the gall-bladder, it might be possible, instead of establishing an external biliary fistula, to open the small intestine at as high a point as possible below the duodenum, and by sutures unite this opening to that made in the gall-bladder, thus re-establishing the flow of bile into the intestine. Von Winiwarter

(*Prag. mediz. Woch.*, No. 21, 1882) attempted this procedure with partial success. New dangers would attend it, but in a favorable case it might be worth at least a trial. Clearly nature meant that the bile should enter the small intestine high up, and play its *rôle* in the digestive process. If, by art, we can re-establish this disordered process without too much danger in the doing it, it should be our aim.

Finally, while loth to differ from one who has had so large and successful an experience as Mr. Tait, we are still firmly convinced that strict antiseptic precautions and methods should be used in this as in all other abdominal sections.

NOTE.

At the last moment, after the foregoing paper was printed, Mr. Tait has kindly sent us the following memorandum of his 13 cases, which we append. Except cases 8 and 13, we presume they are all women.

1.	Aug. 23, 1879.	æt.	40	Married.	Recovery.	Complete cure.
2.	Oct. 9, 1881.	"	55	Single.	Recovery.	Complete cure.
3.	Jan. 15, 1882.	"	24	Married.	Recovery.	Complete cure.
4.	Oct. 13, 1882.	"	39	Married.	Recovery.	Complete cure.
5.	Jan. 5, 1883.	"	28	Single.	Recovery.	Complete cure. No gall-stone found.
6.	May 6, 1883.	"	35	Married.	Recovery.	Complete cure.
7.	May 10, 1883.	"	42	Married.	Recovery.	Complete cure.
8.	May 28, 1883.	"	66	(Man.)	Recovery from operation.	No gall-stone found; obstruction probably due to cancer. Death some time after from this cause.
9.	Nov. 14, 1883.	"	44	....	Recovery.	Complete cure.
10.	Dec. 20, 1883.	"	44	.....	Recovery.	Complete cure.
11.	May 8, 1884.	"	62	Married.	Recovery.	Complete cure.
12.	June 26, 1884.	"	45	Married.	Recovery.	Complete cure.
13.	Aug. 6, 1884.	"	73	(Man)	Recovery.	Complete cure.

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